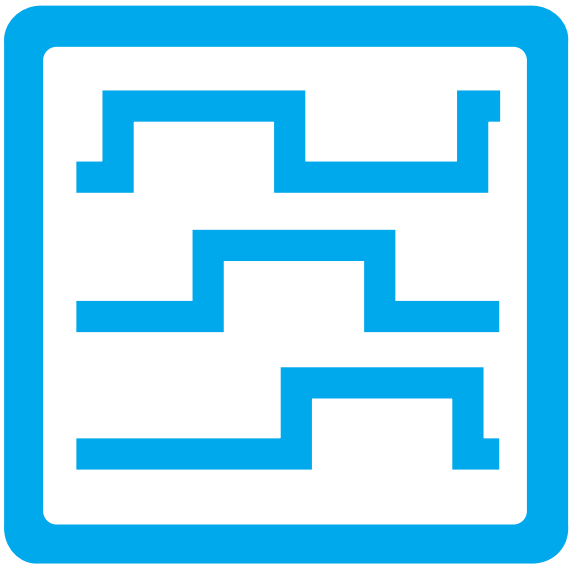


DIGITAL LINK MEASURING INSTRUMENTS

Pulse Pattern Generators 130, 133
Error Detectors 131, 136
10 GHz Jitter Analyzer 138
Digital Data Analyzers 141, 146
SONET/SDH/PDH/ATM Analyzers 150, 169
Portable 2.5G/10G Analyzer 172
Data Quality Analyzer 176
ATM Quality Analyzer 182
PCM Channel Analyzer 188
Digital Transmission Analyzer 194
STM/SONET Analyzer 194
PCM CODEC Analyzer 194

PULSE PATTERN GENERATOR
MP1758A
100 MHz to 12.5 GHz (4 channels)

For Evaluating Versatile Transmission Systems, Modules and Devices

CE GPIB

The MP1758A has a 4-channel data output and a 2-channel clock output. It can generate two patterns: programmable and pseudo-random. The programmable pattern can be up to 128 K bit long for each channel. In addition, seven pseudo-random patterns with periods from $2^7 - 1$ to $2^{31} - 1$ can be generated with a 1/4 phase difference for each channel.
The amplitude and offset voltage of the data/clock output can be set independently for each channel. The setting ranges are 0.5 to 2.0 Vp-p for amplitude, –2.0 to +2.0 V_{OH} for offset voltage, and –500 to +500 ps for delay between the data and clock outputs.

Features
- Four independently adjustable output channels
- PRBS pattern with max. $2^{31} - 1$ bits
- Built-in synthesized clock signal

Specifications

Operation frequency	0.1 to 12.5 GHz (internal or external clock)
External clock	Input level: 0.8 to 2.0 Vp-p Input waveform: sine wave (≥500 MHz) or square wave Connector: APC-3.5
Internal clock	Frequency setting resolution: 1 kHz, 1 MHz Reference signal: 10 MHz (internal/external, selectable)
Pattern	Pseudo-random pattern: 2^n–1 (n = 7, 9, 11, 15, 20, 23, 31) Programmable pattern: max. 128 Kbit x 4 channels Logic inversion: provided Error addition (error rate): 10^{-n} (n = 4, 5, 6, 7, 8, 9), single
Data output	Output waveform: NRZ Number of outputs: 4 (CH 1, CH 2, CH 3, CH 4) Amplitude: 0.5 to 2.0 Vp-p (10 mV steps)*1 Offset voltage: –2.0 to +2.0 V_{OH} (5 mV steps)*1 ECL termination: provided Load impedance: 50 Ω Connector: APC-3.5
Clock output	Number of outputs: 2 (CLOCK 1, CLOCK 2) Amplitude: 0.5 to 2.0 Vp-p (10 mV steps)*1 Offset voltage: –2.0 to +2.0 V_{OH} (5 mV steps)*1 Delay: –500 to +500 ps (1 ps steps) ECL termination: provided Load impedance: 50 Ω Connector: APC-3.5
Sync. output	Number of outputs: 1 (1/32 CLOCK OUTPUT/PATTERN SYNC. OUTPUT, selectable) Amplitude: 0/–1 V Load impedance: 50 Ω Connector: SMA
Control	Control interface: GPIB, parallel Parameter memory: 3.5-inch FD (MS-DOS*2 compatible)
Dimensions and mass	426 (W) x 221 (H) x 450 (D) mm, ≤37 kg
Operating temperature	15˚ to 35˚C
EMC	EN61326: 1997/A1: 1998 (Class A), EN61000-3-2: 1995/A2: 1998 (Class A), EN61326: 1997/A1: 1998 (Annex A)
LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)

∗1: Each channel independently
∗2: MS-DOS is a registered trademark of Microsoft Corporation.

Ordering information
Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MP1758A	Pulse Pattern Generator	
	Standard accessories	
F0079	Fuse, 10 A:	2 pcs
	Power cord, 2.5 m:	1 pc
J0008	GPIB cable, 2 m:	1 pc
J0496	Conversion connector (APC3.5-J · APC3.5-J):	7 pcs
J0696A	Measurement coaxial cable (SMA-P · SMA-P), 0.5 m:	6 pcs
J0696B	Measurement coaxial cable (SMA-P · SMA-P), 0.8 m:	1 pc
J0693A	Measurement coaxial cable (HRM202B-3D2W-HRM202B), 1.0 m (for sync. output):	1 pc
Z0168	3.5-inch floppy disk (2HD):	2 pcs
W0926AE	MP1758A operation manual:	1 copy
W0927AE	MP1758A GPIB operation manual:	1 copy
Z0306A	Wrist strap:	1 pc
	Options	
MP1758A-01	CLOCK/$\overline{\text{CLOCK}}$ output (factory option)	
MP1758A-02	Cross point adjustment (factory option)	
	Optional accessories	
J0500A	Semi-rigid cable (SMA-P · SMA-P), 0.5 m	
MB24B	Portable Test Rack (rating current of power cord and plug: 20 A)	
J0007	GPIB cable, 1 m	

For product ordering information, see pages 4 – 10

ERROR DETECTOR
MP1776A
100 MHz to 12.5 GHz

Supports Measurement for up to 50 Gbit/s System (Installed with 4 Channels)

NEW

CE

MP1776A is an error detector housing four error detectors that can measure error up to 12.5 Gbit/s. It has four-channels independent measurement mode, two-channels or four-channels combined measurement mode and be used for development, manufacturing and maintenance of transmission systems and modules from 12.5 Gbit/s to maximum 50 Gbit/s.

Features
- Max. 4-channels in one box
- Independent measurement of 4-channels
- PRBS patterns from $2^7 - 1$ to $2^{31} - 1$
- Max. 32 Mbit programmable pattern at 4-channels combined mode (corresponding six frames of STM-256/ STS-768)
- Burst data BER measurement for optical circulating loop test
- Good operability by GUI
- Display 4-channels measurement results on screen

Specifications
• MP1776A (main frame), MU177601B (12.5 Gbit/s Error Detector)

Operating frequency	100 MHz to 12.5 GHz
Measurement pattern	PRBS pattern: $2^n - 1$ (n: 7, 9, 11, 15, 20, 23, 31) Zero substitution pattern: 2^n (n: 7, 9, 11, 15), consecutive zero-pattern can be inserted up to pattern length – 1 Programmable data Independent: 2 to 8,388,608 bits 2-channels combined: 4 to 16,777,216 bits 4-channels combined: 8 to 33,554,432 bits Logic inversion: Positive/negative switching possible
Measurement mode	Independent[*1], 2-channels combined[*2], 4-channels combined[*3]
Synchronization method	Normal, frame
Error detection mode	Insertion, omission, total
Measurement items	Error ratio: 0.0000 x 10^{-16} to 1.0000 x 10^0 Error count: 0 to 9,999,999, 1.0000 x 10^7 to 9.9999 x 10^{16} Clock frequency: 0.1 to 12.5 GHz (independent), 0.2 to 25 GHz (2-channels combined), 0.4 to 50 GHz (4-channels combined) *Resolution: 1 kHz, accuracy: 10 ppm ±1 kHz
Sync threshold value	Internal, 10^{-n} (n: 2, 3, 4, 5, 6, 7, 8)
Auto search function	Supported
Data input	Input waveform: NRZ Input amplitude: 0.5 to 2.0 Vp-p Threshold voltage: –3.000 to +1.750 V (1 mV step) Termination condition: GND/–2.0 V Input impedance: 50 Ω Connector: APC-3.5 Number of input: 1 (MU177601B 12.5 Gbit/s Error Detector Unit)
Clock input	Input level: 0.5 to 2.0 Vp-p Input waveform: Square wave only (<0.5 GHz, Duty: 50%), Sine or square wave (≥0.5 GHz, duty: 50%) Clock delay: ±500 ps (1 ps step) Polarity inversion: POS/NEG inversion selectable Input impedance: 50 Ω Connector: APC-3.5 Number of input: 1 (MU177601B 12.5 Gbit/s Error Detector Unit, up to 4 channel can be added.)

Continued on next page

Resync input	Input level: 0/–1 V ±0.1 V, Connector: SMA
System environment	Display: 10.4-inch, color LCD, touch screen, 640 x 480 dots, 256 colors (16 M colors in VGA when external display is connected.) Printer: Parallel port for external printer (D-sub 25-pin) Keyboard: 101-type (English), PS/2 (mini DIN 6-pin) Mouse: Serial, PS/2 (mini DIN 6pin) FDD: 3.5-inch, 2 models (740 KB, 1.44 MB) HDD C drive: ≥474 MB (Used for system: measurement data, pattern) D drive: ≥30 MB (Not accessible to users, interface: IDE)
Remote control	RS-232C (standard, D-sub 9-pin), GPIB (IEEE488.2)
Power	90 to 120 Vac/180 to 250 Vac, 47.5 to 63 Hz, ≤1000 VA
Operating temperature	+15˚ to +35 ˚C
Dimensions and mass	426 (W) x 266 (H) x 584 (D) mm, ≤50 kg (with 4 units of MU177601B)
EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)

∗1: Different measurement pattern and frequency can be set for each channel.
∗2: Evaluates 1:2 DEMUX to check that the signal before demultiplexing is PRBS.
∗3: Evaluates 1:4 DEMUX to check that the signal before demultiplexing is PRBS.

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/order No.	Name	
	Main frame	
MP1776A	Error Detector	
	Standard accessories	
J0491	Power cord (with shield, 13 A):	1 pc
J0670A	Power cord (L-type, C7, for 200 V main), 2.5 m:	1 pc
F0074	Fuse, 10 A:	1 pc
Z0319A	PS/2 mouse:	1 pc
Z0320	Input pen:	1 pc
W1410AE	MP1776A operation manual:	1 copy
W1411AE	MP1776A remote operation manual:	1 copy
Z0306A	List strap:	1 pc
Z0352	MP1776A recovery tool:	2 pcs
Z0396A	Pen holder:	1 pc
	Unit	
MU177601B	12.5 Gb/s Error Detector Unit	
	Standard accessories	
J0696B	Coaxial cable (SMA-P · SMA-P), 0.5 m:	2 pcs
J0693A	Coaxial cable (HRM202B · 3D2W · HRM202B), 1 m:	1 pc
	Optional accessories	
Z0321A	Keyboard (PS/2)	
J0008	GPIB cable, 2 m	
B0496	Portable test rack	
B0374G	Carrying case	
B0497A	Dummy unit (for Slot 5)	
B0497B	Dummy unit (for Slot 1 to Slot 4)	
Z0416	Head cleaning disk (for 3.5-inch FDD)	

For product ordering information, see pages 4 – 10

PULSE PATTERN GENERATOR
MP1763C
12.5 GHz

For R&D of High-Speed Logic, ICs, Optical Modules and Devices

CE GPIB

The MP1763C is used in combination with the MP1764C Error Detector. The amplitude of the clock and data signals can be varied from 0.25 to 2 Vp-p while the offset can be adjusted to within ±2 V so that the amplitude and the offset margin can be measured. The clock has a variable delay function so that time-dependent characteristics or phase margins of the input clock and data can be measured. An M series pseudorandom pattern representative of actual conditions or a programmable pattern can be selected as cell data.
In addition, a 3.5 inch floppy disk drive is built in for storing preset data, enabling rapid measurements to be performed by simply pressing a key. A GPIB function is provided, enabling automatic or remote measurement via an external controller.
The MP1763C is a pulse pattern generator ideal for research and development of high-speed logic, ICs, and digital systems.

MX176400A Q and Eye Analysis Software controls MP1763C and MP1764C from the PC to measure Q factor, eye margin, and eye diagram. MX176401A SDH/SONET Pattern Editor controls the MP1763C and MP1764C to generate frame pattern conforming to SDH/SONET standards.

Features
- High quality waveform
- Low FM/PM-noise clock generator
- 8 Mbit programmable pattern corresponding to six frames of STM-64/STS-192
- Generates PRBS patterns with bit length from $2^7 - 1$ to $2^{31} - 1$ bits
- Complementary outputs of both data and clock
- The amplitudes and offsets of all 8 data outputs that have 1/8 speed of fundamental clock signal can be set

Specifications
• MP1763C (main frame)

Operation frequency		0.05 to 12.5 GHz
Internal clock (option 01)	Frequency range	0.05 to 12.5 GHz
	SSB phase noise (at 10 kHz offset, 1 Hz bandwidth)	≤–85 dBc/Hz (0.05 to 4 GHz), ≤–80 dBc/Hz (4 to 8 GHz), ≤–75 dBc/Hz (8 to 10 GHz), ≤–70 dBc/Hz (10 to 12.5 GHz)
External clock input level		0.4 to 2.5 Vp-p
Pattern	Pseudorandom binary sequence pattern (PRBS)	Pattern: $2^n - 1$ (n: 7, 9, 11, 15, 20, 23, 31) Mark ratio: 1/2, 1/4, 1/8, 0/8 ($\overline{1/2}$, 3/4, 7/8, 8/8 are possible with logic inversion) Bit shifts number for mark ratio varied: 1, 3 bits selectable
	Data pattern	Data length: 2 to 8388608 bits
	Alternate pattern	A/B pattern data length: 128 to 4194304 bits (128 bit steps); Loop time: A, B pattern (1 to 127, 1 steps)
	Zero substitution pattern	Zero bit length: 1 to (pattern length – 1) bits; Pattern: 2^n (n: 7, 9, 11, 15)
	Error addition	Error rate: 10^{-n} (n: 4, 5, 6, 7, 8, 9), and single error External error injection: Provided

Continued on next page

Data output	Number of outputs	2 (DATA/$\overline{\text{DATA}}$ independently)
	Amplitude	0.25 to 2 Vp-p, 2 mV steps
	Offset voltage	V_{OH}: –2 to +2 V, 1 mV steps Display: V_{OH}, V_{TH} or V_{OL} selectable
	Rise/fall time	Typical 30 ps (10% to 90% of amplitude)
	Pattern jitter	≤20 psp-p, typical 10 psp-p
	Waveform distortion (0-peak)	≤15% or ≤150 mV whichever is greater
	Gating input	Provided
	Load impedance	50 Ω (with back termination)
	Connector	APC-3.5
	DATA/$\overline{\text{DATA}}$ tracking	$\overline{\text{DATA}}$ amplitude and offset voltage can be set to the same values as for DATA.
	Cross point adjustment function	The cross point of DATA and $\overline{\text{DATA}}$ outputs can be adjusted at semifixed resistor of side.
Clock output	Number of outputs	3 (CLOCK 1/$\overline{\text{CLOCK 1}}$, CLOCK 2)
	Amplitude	CLOCK 1/$\overline{\text{CLOCK 1}}$: 0.25 to 2 Vp-p (2 mV steps) CLOCK 2: 1 Vp-p
	Offset voltage	CLOCK 1/$\overline{\text{CLOCK 1}}$: V_{OH} –2 to +2 V (1 mV steps) CLOCK 2: V_{OH} 0 V fixed
	Rise/fall time	Typical 30 ps (10% to 90% of amplitude)
	Load impedance	50 Ω (CLOCK 1/$\overline{\text{CLOCK 1}}$: with back termination)
	Connector	CLOCK 1/$\overline{\text{CLOCK 1}}$: APC-3.5, CLOCK 2: SMA
	Delay	±500 ps (1 ps steps)
1/8 data and clock output		Number of outputs: DATA 8, CLOCK 1 Output level: ECL Connector: SMA
1/4 data and clock output (option 03)*1	Number of outputs	DATA: 4, CLOCK: 1
	Amplitude	0.5 to 2 Vp-p (2 mV steps)
	Offset voltage	V_{OH}: –1.5 to +1.5 V (1 mV steps)
	Connector	SMA
Sync. signal output	Number of outputs	1 (1/64 clock, fixed position pattern, or variable position pattern selectable)
	Output level	0/–1 V
	Connector	SMA
Parameter memory		Media: 3.5 inch FD (2HD, 2DD) Format: MS-DOS (Rev. 3.1)*2 Content: Pattern or other parameters
Operating temperature range		0˚ to +50˚C
Dimensions and mass		426 (W) x 221 (H) x 450 (D) mm, ≤33 kg
Power		≤400 VA
EMC		EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
LVD		EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)

∗1: When the Option 03 (1/4 speed output) is added, the 1/8 speed output is not available.
∗2: MS-DOS is a registered trademark of Microsoft Corporation.

• MX176400A Q and Eye Analysis Software

Required system	Computer: IBM-PC/AT or full compatible, OS: Windows 95/98/NT, CPU: Pentium 166 MHz or higher, Memory: 64 MB or more, Hard disk space: 100 MB or more GPIB: National Instruments made GPIB interface (PCMCIA-GPIB or AT-GPIB/TNT series boards are recommended.) Display Resolution: 800 x 600 or more, Display colors: 256 or more ∗If two or more applications are running simultaneously, operation cannot be guaranteed.
Functions	Measurement frequency: 2 to 12.5 GHz (eye diagram/eye margin measurement), 1 to 12.5 GHz (Q factor measurement) Measurement patterns: PRGM, PRBS 7, 9, 11, 15, 20, 23, 31 Pattern format: Continuous/burst (To be synchronized within 1 s) Eye margin measurement Measurement resolution (threshold): 1 to 10 mV (1 mV steps), Measurement resolution (phase): 1 to 10 ps (1 ps steps), Measurement rate: E-2 to E-15 Eye diagram measurement Measurement resolution (phase): 1 to 10 ps (1 ps steps) Measurement rate: E-2 to E-15 (actual measurement), E-3 to E-12 (estimate measurement) Display rate: E-2 to E-15 (actual measurement), E-2 to E-4915 (estimate measurement) Mask test judgment rate: E-2 to E-15 Q factor measurement Measurement style: Multiple measurements at fixed phase/phase vs. Q factor measurements Bit error rate range: Upper limit at E-3 to E-5, lower limit at E-7 to E-12 Minimum error count (measurement accuracy): 1, 10, 100, 1000 Vth shift width: Automatic, fixed (1 to 10 mV/1 mV/steps)

For product ordering information, see pages 4 –10

• MX176401A SDH/SONET Pattern Editor

Required system	Computer: IBM-PC/AT or full compatible, CPU: Pentium 200 MHz or higher, OS: Windows 95/98/NT, Memory: 64 MB or more Display Resolution: 800 x 600 or more; Display colors: 256 or more FDD: 3.5-inch (1.44 MB), Hard disk space: 100 MB or more GPIB: National Instruments-made GPIB interface (PCMCIA-GPIB or AT-GPIB/TNT series boards are recommended.)
Functions	SDH/SONET pattern editor Mapping: STM-N (N = 1, 4c, 12c, 16c, 32c, 64c), STS-N SPE (N = 1, 3c, 12c, 48c, 192c) Pattern edit: Arbitrary editing of program patterns (PRBS pattern can be inserted in the payload.), time indication, table indication/edit Payload: Free format, ALL 0, ALL 1, PRBS $2^n - 1$ (n = 7, 9, 11, 15, 20, 20z, 23, 31) ∗Pattern repetition up to the length of all frames Measurement condition: ALL, payload, SOH ALL, POH ALL, OH (D1-D3), OH (D4-D12), OH (1 byte) ∗Pattern repetition up to the length of all frames CID pattern: Available Frame repetition: Maximum 6 frames Alarm addition: Alarm addition conforming to SDH/SONET Standard; [items: OOF/LOF, MS-AIS (L-AIS), MS-RDI (L-RDI), MS-REI (L-REI), HP-AIS (P-AIS), HP-REI (P-REI), HP-RDI (P-RDI)] BIP error addition: Generates parity errors of B1, B2, and B3 B1, B2, and B3 calculation: Available Scramble: Available BIP correction: Available Bit window: Active for patterns without frame Block window: Active for patterns without frame with a pattern length of multiples of 32 OH editor: Available

Windows is a registered trademark of Microsoft Corporation of the U.S. in the United States and other countries. IBM and AT are registered trademarks of International Business Machines. Pentium is a registered trademark of Intel Corporation. PCMCIA-GPIB and AT-GPIB/TNT are registered trademarks of National Instruments.

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MP1763C	Pulse Pattern Generator	
	Standard accessories	
J0500A	Semi-rigid cable (SMA-P · SX-36 · SMA-P), 0.5 m:	2 pcs
J0672D	Semi-rigid cable, 7 cm:	1 pc
J0672F	Semi-rigid cable, 10 cm:	1 pc
J0693A	SMA cable (HRM202B · 3D2W · HRM202B), 1 m:	1 pc
J0496	APC-3.5 J-J connector:	4 pcs
J0008	GPIB cable, 2 m:	1 pc
	Power cord:	1 pc
Z0168	3.5 inch floppy disk (MF2HD-3.5MF):	2 pcs
Z0306A	Wrist strap:	1 pc
F0014	Fuse, 6.3 A (T6.3A250V):	1 pc
W1848AE	MP1763C operation manual:	1 copy
W1849AE	MP1763C GPIB operation manual:	1 copy
Z0481	12.5G/3.2G BERTS application software demo:	1 pc
B0021	Protective cover (for 1MW · 5U):	1 pc
	Options	
MP1763C-01	12.5 GHz synthesizer (50 MHz to 12.5 GHz)	
MP1763C-03	1/4 speed output	
	Application equipment	
68347B	Synthesized Sweep Generator (10 MHz to 20 GHz)	
	Application software	
MX176400A	Q and Eye Analysis Software	
MX176401A	SDH/SONET Pattern Editor	
	Optional accessories	
J0500B	Semi-rigid cable (SMA-P · SX-36 · SMA-P), 1 m	
J0322A	Coaxial cable (11SMA · SUCOFLEX104 · 11SMA), 0.5 m	
J0322B	Coaxial cable (11SMA · SUCOFLEX104 · 11SMA), 1 m	
J0007	GPIB cable, 1 m	
Z0054	3.5 inch floppy disk (MF2DD-3.5MF)	
MB24B	Portable Test Rack (rating current of power cord and plug: 20 A)	
B0413A	Carrying case	
B0163	Soft carrying case	
B0044	Rack mount (for 1MW · 5U panel)	
Z0292A	Stacking rack (for sweep synthesizer)	
Z0416	3.5 inch head cleaning disk	

ERROR DETECTOR
MP1764C
12.5 GHz

For R&D of High-Speed Logic, ICS, Optical Modules and Devices

GPIB

The MP1764C is used in combination with the MP1763C Pulse Pattern Generator to detect errors used to evaluate conformity with ITU-T standards. In addition, complicated searching for input thresholds or phase adjustments is simplified with the touch of a single key. These functions are ideally suited for the research and development of ultrahigh-speed logic ICs and digital communication systems.
MX176400A Q and Eye Analysis Software controls MP1764C and MP1763C from the PC to measure Q factor, eye margin, and eye diagram. MX176401A SDH/SONET Pattern Editor controls the MP1764C and MP1763C to generate frame pattern conforming to SDH/SONET standards.

Features
- Auto-search function for setting optimum values of input threshold and phase setting by a “one-touch” operation
- Synchronization of 8 Mbits pattern is easily made within a short period of time (when in frame mode)
- Errors are detected in intervals as short as 0.1 sec.
- Zero wait time counter gate

Specifications

Operation frequency		0.05 to 12.5 GHz
Data input	Input waveform	NRZ
	Input amplitude	0.25 to 2.0 Vp-p
	Threshold voltage variable range	–3.000 to +1.875 Vp-p (1 mV steps)
	Phase margin	≥70 ps (typical value at 10 Gb/s, PRBS 2^{23} – 1, and an input amplitude of 1 Vp-p)
	Input sensitivity	50 mVp-p (typical value at 10 Gb/s and PRBS 2^{23} – 1
	Termination	Connected to GND or –2 V via a 50 Ω termination
	Connector	APC-3.5
Clock input	Input waveform	Rectangular wave (<0.5 GHz), rectangular or sine wave (≥0.5 GHz), duty factor: 50%
	Input voltage	0.25 to 2.0 Vp-p
	Input delay variable range	±500 ps (1 ps steps)
	Polarity inversion	CLOCK/$\overline{\text{CLOCK}}$ inversion possible
	Termination	Connected to GND or –2 V via a 50 Ω termination
	Connector	APC-3.5
Auto search function		Provided
Receive pattern	Pseudorandom binary sequence pattern (PRBS)	Pattern: 2^n – 1 (n: 7, 9, 11, 15, 20, 23, 31) Mark ratio: 1/2, 1/4, 1/8, 0/8 (1/2, 3/4, 7/8, 8/8 are possible with logic inversion.) Number of AND bit shift at mark ratio setting: 1, 3 bits (selectable by using DIP switch on rear panel)
	Data pattern	Data length: 2 to 8388608 bits
	Alternate pattern	A/B pattern word length: 128 to 4194304 bits (128 bits steps), Number of loops: Controlled using external signal
	Zero substitution pattern	Zero bit length: 1 to (pattern length –1) bits, Pattern length: 2^n (n: 7, 9, 11, 15)

Continued on next page

For product ordering information, see pages 4 – 10

Synchronous mode		Normal, frame, quick
Synchronous threshold		Preset value or 10^{-n} (n: 2, 3, 4, 5, 6, 7, 8)
Error detection mode		Omission insertion, total (selectable with DIP switch on rear panel)
Measure-ment item	Error rate	0.0000 x 10^{-16} to 1.0000 x 10^{-0}
	Number of errors	0 to 9.9999 x 10^{16}
	Error interval (asynchronous)	0 to 9999999 (interval: 1 ms, 10 ms, 100 ms, 1 s)
	Error free interval (EFI)	0.0000% to 100.0000%
	Clock frequency	0.05 to 12.5 GHz, (resolution: 1 kHz, accuracy: 10 ppm ±1 kHz)
Eye margin measurement function		Provided
Error performance data calculation function		Provided
Measurement CH mask		1 to 32 ch (settable independently)
Block window		Error for any block of 32-bit segments can be measured.
Error analysis (option 01)		Pattern (256 bits in total) before and after bit in which error occurred is stored.
Auxiliary output	Error output (direct)	1/128 OR error, Output level: 0/–1 V, Connector: SMA
	Error output (stretched)	Pulse width: 350 ns (typical), Output level: TTL, Connector: BNC
	Alarm output (clock loss, sync. loss)	Output level: TTL Connector: BNC
	Sync. gain output	Output level: 0/–1 V; Connector: SMA
Auxiliary input	External mask input	Input level: 0/–1 V; Connector: SMA
	Resync. input	Input level: 0/–1 V; Connector: SMA
	Alternate A/B switching input	Input level: ECL; Connector: SMA
Sync. signal output	Number of outputs	1 (1/32 clock, fixed position pattern, or variable position pattern selectable)
	Output level	0/–1 V
	Connector	SMA
Parameter memory		Media: 3.5 inch FD (2HD, 2DD) Format: MS-DOS (Rev. 3.1)*1 Content: Pattern or other parameters
Operating temperature range		0˚ to +50˚C
Dimensions and mass		426 (W) x 221.5 (H) x 450 (D) mm, ≤30 kg
Power		≤300 VA
EMC		EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
LVD		EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)

*1: MS-DOS is a registered trade mark of Microsoft Corporation.

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name
	Main frame
MP1764C	Error Detector
	Standard accessories
J0500A	Semi-rigid cable (SMA-P · SX-36 · SMA-P), 0.5 m: 2 pcs
J0693A	SMA cable (HRM202B-3D2W-HRM202B), 1 m: 3 pcs
J0496	APC-3.5 J-J connector: 2 pcs
J0008	GPIB cable, 2 m: 2 pc
	Power cord: 1 pc
Z0168	3.5 inch floppy disk (MF2HD-3.5MF): 2 pcs
F0014	Fuse, 6.3 A (T6.3A250V): 1 pc
W1846AE	MP1764C operation manual: 1 copy
W1847AE	MP1764C GPIB operation manual: 1 copy
B0306A	Wrist strap: 1 pc
B0021	Protective cover (for 1MW · 5U): 1 pc
B0481	12.5G/3.2G BERTS application software demo: 1 pc
	Option
MP1764C-01	Error analysis

Model/Order No.	Name
	Application software
MX176400A	Q/Eye Analysis Software
MX176401A	SDH/SONET Pattern Editor
	Optional accessories
J0500B	Semi-rigid cable (SMA-P · SX-36 · SMA-P), 1 m
J0322A	Coaxial cable (11SMA ·SUCOFLEX104 ·11SMA), 0.5 m
J0322B	Coaxial cable (11SMA · SUCOFLEX104 · 11SMA), 1 m
J0007	GPIB cable, 1 m
Z0054	3.5 inch floppy disk (MF2DD-3.5MF)
MB24B	Portable Test Rack (rating current of power cord and plug: 20A)
B0413A	Carrying case
B0163	Soft carrying case
B0044	Rack mount (for 1MW · 5U panel)
Z0416	3.5 inch head cleaning disk

10 GHz JITTER ANALYZER

MP1777A

STM-16 to 64, OC-48 to 192

For Evaluating STM-64/OC-192 Jitter

GPIB

The MP1777A is a measurement solution for jitter evaluation. It supports both the STM-16/32/64 and OC-48/96/192 bit rates. In addition to supporting the bit rates of 2488.32, 4976.64, and 9953.28 MHz two additional bit rates used in submarine cable systems can be added as options.
The MP1777A can evaluate jitter characteristics, including jitter tolerance, jitter transfer, and output jitter, which are parameters most commonly used to evaluate digital lines.
The MX177701A Jitter Performance Test Software (bundled with MP1777A) allows the MP1777A to be controlled remotely. When the Jitter Performance Test Software is used together with specified auxiliary measuring instruments, jitter tolerance and jitter transfer characteristics can be measured automatically.

Functions

• Conforms to 0.172 new recommendations
The MP1777A meets the STM-64/OC-192 measurement standards. It is compatible with bandwidths up to 80 MHz and jitter modulation amplitudes up to 3200 UIp-p.

• Four optional series of bit rates
Current submarine cable systems add FEC (forward error correction) to signals to enhance quality. The MP1777A can also support two series of bit rates by adding Option 01 (2494.16, 4988.32, 9976.64 MHz), Option 02 (2666.0571, 5332.1142, 10664.2284 MHz), Option 04 (3062.2629, 6124.7259, 12249.4517 MHz) and Option 05 (3069,6138,12276 MHz).

• Automatic jitter measurement
The MX177701A Jitter Performance Test Software is used for automatic jitter measurement and can be used with the MP1777A to configure an automatic measurement system for jitter tolerance and jitter transfer characteristics*1.

*1: Requires MS4630B Network Analyzer, MP1763C Pulse Pattern Generator and MP1764C Error Detector for automatic measurement of jitter tolerance. Requires MS4630B Network Analyzer and MP1763C Pulse Pattern Generator for automatic measurement of jitter transfer. Also requires controller, MX177701A Jitter Performance Test Software, GPIB card, and cables.

Application examples

• Jitter Generation
To generate jitter, an external signal generator is required to source a modulation signal. The MX177701A Jitter Performance Test Software and a GPIB card are required for automatic measurement. It is also possible to perform manual measurements, which does not require these items.

• Jitter measurement
The MP1777A can measure the jitter of input signals directly without using an external BPF. When Option 10 (High Sensitive Input) is installed, it can measure the jitter of input signals with amplitudes down to 150 mVp-p. In this case, it can perform evaluation by direct device connection. The MX177701A Jitter Performance Test Software and a GPIB card are required for automatic measurement. Manual measurement is also possible and the measurement results are checked on the MP1777A screen. Furthermore, UIp-p, UI+p, UI-p, and UIrms can also be measured.
By combining the MP9677B E/O, O/E converter, the MP1777A can measure the jitter measurement of optical interfaces.

• Jitter tolerance measurement
By combining the O/E and E/O converters, the MP1777A can measure the jitter tolerance of optical interfaces. The MX177701A Jitter Performance Test Software and a GPIB card are required for automatic measurement. It is also possible to perform manual measurements without these items.

• Measuring Jitter Transfer Characteristics
The MP1777A can evaluate jitter transfer characteristics up to 80 MHz in applications such as 10 Gbit/s clock recovery module (O/E converter) evaluation. Automatic (using MX177701A external software/GPIB) and manual measurements are possible.
By combining the MP9677B E/O, O/E converter, the MP1777A can evaluate the jitter transfer characteristics up to 80 MHz at optical interfaces.

For product ordering information, see pages 4 – 10

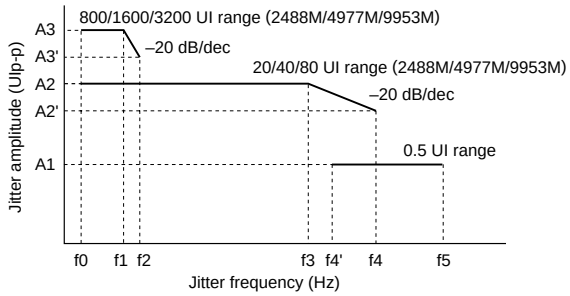
Specifications

Bit rate

Standard: 2488.32, 4976.64, 9953.28 Mbit/s
Option 01: 2494.16, 4988.32, 9976.64 Mbit/s
Option 02: 2666.0571, 5332.1143, 10664.2286 Mbit/s
Option 04: 3062.3629, 6124.7259, 12249.4517 Mbit/s
Option 05: 3069,6138,12276 Mbit/s
∗The Option 02 and 04 cannot be mounted at the same time.

Jitter generation

Modulation frequency: 10 Hz to 80 MHz
Amplitude: 0 to 3200 UIp-p
Resolution: 0.001 UIp-p (0.5 UI range), 0.01 UIp-p (20, 40, 80 UI range), 1 UIp-p (800, 1600, 3200 UI range)



Bit rate (bit/s)	f0 (Hz)	f1 (Hz)	f2 (Hz)	f3 (kHz)	f4 (MHz)	f4' (kHz)	f5 (MHz)	A1 (UIp-p)	A2' (UIp-p)	A2 (UIp-p)	A3' (UIp-p)	A3 (UIp-p)
2488M	10	15	480	100	2	100	20	0.5	1	20	25	800
4977M	10	15	480	100	2	100	40	0.5	2	40	50	1600
9953M	10	15	480	100	2	100	80	0.5	4	80	100	3200

Accuracy:
±5% ±10 UIp-p/Fr (3200 UI range), ±5% ±8 UIp-p/Fr (1600 UI range), ±5% ±5 UIp-p/Fr (800 UI range),
±5% ±0.8 UIp-p/Fr (80 UI range), ±5% ±0.6 UIp-p/Fr (40 UI range), ±5% ±0.3 UIp-p/Fr (20 UI range),
±5% ±0.1 UIp-p/Fr (0.5 UI range/10G), ±5% ±0.08 UIp-p/Fr (0.5 UI range/5G), ±5% ±0.05 UIp-p/Fr (0.5 UI range/2.5G)
Fr: 100 kHz (0.5, 20, 40, 80 UI range), 10 Hz (800, 1600, 3200 UI range)
Frequency response error (Fr Hz):
±5% (10 to 20 Hz), ±2% (20 Hz to 300 kHz), ±3% (300 kHz to 1 MHz), ±5% (1 to 3 MHz), ±10% (3 to 10 MHz), ±15% (10 to 80 MHz)

Frequency offset

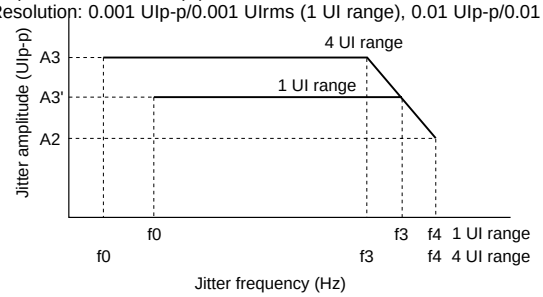
Range: ±50 ppm (0.1 ppm steps)
Accuracy: ±0.1 ppm (after power-on, calibrates after 60 min. warm-up 23 ±5°C)

Auxiliary interface

External modulation input, external 10 MHz reference input, DCS input, external reference clock input

Jitter measurement

Modulation frequency: 100 Hz to 80 MHz
Amplitude: 0 to 4.00 UIp-p, 0 to 1.41 UIrms
Resolution: 0.001 UIp-p/0.001 UIrms (1 UI range), 0.01 UIp-p/0.01 UIrms (4 UI range)



Bit rate (bit/s)		A2 (UIp-p)	A3' (UIp-p)	A3 (UIp-p)	f0 (Hz)	f3 (MHz)	f4 (MHz)
2488M	1 UI range	0.5	1	—	100	10	20
	4 UI range	0.5	—	4	100	2.5	20
4977M	1 UI range	0.5	1	—	100	20	40
	4 UI range	0.5	—	4	100	5	40
9953M	1 UI range	0.5	1	—	100	40	80
	4 UI range	0.5	—	4	100	10	80

Continued on next page

<table>
<tr><td>MHz)

Jitter measurement</td><td>Accuracy
[UIp-p]: ±5% ±W UIp-p (Fr Hz)
[UIrms]: ±5% ±Y UIrms (Fr Hz), Fr: 100 kHz
Frequency response error (Fr Hz):
±5% (10 to 20 Hz), ±2% (20 Hz to 300 kHz), ±3% (300 kHz to 1 MHz), ±5% (1 to 3 MHz), ±10% (3 to 10 MHz), ±15% (10 to 80
<table>
<tr><th rowspan="2">Bit rate (bit/s)</th><th colspan="2">W (UIp-p)*1</th><th colspan="2">Y (UIrms)*2</th></tr>
<tr><th>1 UI</th><th>4 UI</th><th>1 UI</th><th>4 UI</th></tr>
<tr><td>2488M</td><td>0.05</td><td>0.22</td><td>0.008</td><td>0.08</td></tr>
<tr><td>4977M</td><td>0.07</td><td>0.24</td><td>0.009</td><td>0.09</td></tr>
<tr><td>9953M</td><td>0.09</td><td>0.26</td><td>0.010</td><td>0.10</td></tr>
</table>
*1: With HP1 + LP, *2: With HP + LP
Filters: LP, HP1 + LP, HP1' + LP, HP2 + LP, HP + LP, HP' + LP
<table>
<tr><th>Bit rate (bit/s)</th><th>HP1 (kHz)</th><th>HP1' (kHz)</th><th>HP2 (MHz)</th><th>HP (kHz)</th><th>HP' (kHz)</th><th>LP (MHz)</th></tr>
<tr><td>2488M</td><td>5</td><td>—</td><td>1</td><td>12</td><td>—</td><td>20</td></tr>
<tr><td>4977M</td><td>8</td><td>—</td><td>2</td><td>12</td><td>—</td><td>40</td></tr>
<tr><td>9953M</td><td>10</td><td>20</td><td>4</td><td>12</td><td>50</td><td>80</td></tr>
</table>
</td></tr>
<tr><td>Auxiliary interface</td><td>Demodulation output</td></tr>
<tr><td>Internal memory</td><td>Measurement conditions: 10</td></tr>
<tr><td>Others</td><td>GPIB, Buzzer, Time</td></tr>
<tr><td>Dimensions and mass</td><td>426 (W) x 221.5 (H) x 451 (D) mm, ≤23 kg (with options)</td></tr>
<tr><td>Power</td><td>100 to 240 Vac, 47.5 to 63 Hz, ≤350 VA</td></tr>
<tr><td>Temperature</td><td>10˚ to 40˚C</td></tr>
<tr><td>EMC</td><td>EN61326: 1997/A1, 1998 (Class A)
EN61000-3-2: 1995/A2, 1998 (Class A)
EN61326: 1997/A1, 1998 (Annex A)</td></tr>
<tr><td>LVD</td><td>EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)</td></tr>
</table>

• Operation environment

Applicable instruments	Pulse Pattern Generators: MP1763C (12.5 GHz), MP1570A (SONET/SDH/PDH/ATM Analyzer) Error Detectors: MP1764C (12.5 GHz), MP1570A (SONET/SDH/PDH/ATM Analyzer) Network Analyzer: MS4630B (300 MHz, with Option 10)
Recommended controller	Personal computer: IBM-PC/AT compatible OS: Windows®95 (English) or Windows®98 (English) CPU: Pentium (75 MHz or faster) Memory size: 16 Mbyte min. HDD free space: ≥300 kbyte for full install GPIB interface: National Instruments AT-GPIB/TNT (PnP), AT-GPIB/TNT+, PCMCIA-GPIB, or PCMCIA-GPIB+ and Windows® driver (for Windows®95 or Windows®98) Swap file size: ≥40 Mbyte guaranteed Display colors: Set to 256 Number of applications running simultaneously: 1 (unable to run other applications simultaneously)

Windows®95 and Windows®98 are registered trademarks of Microsoft® Corporation.

Ordering information

Please specify model/order number, name, and quality when ordering.

Model/Order No.	Name	
	Main frame	
MP1777A	10 GHz Jitter Analyzer	
	Standard accessories	
	AC power cord:	1 pc
F0014	Fuse, 6.3 A:	2 pcs
B0329D	Front cover:	1 pc
W1497AE	MP1777A operation manual:	1 copy
W1498AE	MP1777A remote control operation manual:	1 copy
J0496	APC 3.5 J-J connector:	2 pcs
J0900E	SMA cable (50 Ω), 1.5 m (AA-165-1500):	2 pcs
J0776C	BNC cable (50 Ω), 1 m:	3 pcs
J0008	GPIB cable, 2 m:	1 pc
MX177701A	Jitter Performance Test Software*1:	1 pc
W1499AE	MX177701A operation manual:	1 copy

Model/Order No.	Name
	Options
MP1777A-01	2494M/4988M/9977M jitter*2
MP1777A-02	2666M/5332M/10664M jitter*3
MP1777A-04	3062M/6124M/12249M jitter*4
MP1777A-05	3069M/6138M/12276M jitter*5
MP1777A-10	High sensitive input (0.15 to 1.3 Vp-p)
	Application equipment
MS4630B	Network Analyzer (10 Hz to 300 MHz, with Option 10)
MP1763C	Pulse Pattern Generator (12.5 GHz)
MP1764C	Error Detector (12.5 GHz)
MP1570A	SONET/SDH/PDH/ATM Analyzer
MP9677B	E/O, O/E Converter

*1: Please confirm the operating system.
*2: 2494.16, 4988.32, 9976.64 MHz
*3: 2666.0571, 5332.1142, 10664.2284 MHz
*4: 3062.3629, 6124.7259, 12249.4517 MHz
*5: 3069,6138,12276 MHz

For product ordering information, see pages 4 – 10

DIGITAL DATA ANALYZER
MP1630B
10 kHz to 200 MHz

For R&D and Manufacturing of Digital Devices and Equipment

GPIB
OPTION

The MP1630B is a general-purpose bit error measuring instrument that can provide simultaneous measurements of multi-channel signals and burst signal measurements up to 200 MHz.
The MP1630B is not only for continuous signals – it can measure burst-signal bit error rates as well. Consequently, it is easily able to handle burst signals used by TDMA (Time Domain Multiplex Access) methods and packet/cell transmissions, etc. Both a pulse pattern generator unit and an error detector unit can be installed in the MP1630B to measure simultaneously parallel data for 16 channels using just one unit.

Features
- 16 channel PPG and ED in one cabinet
- Eye diagram measurement based on BER

Applications
- Testing multi-channel modules for optical interconnection
- E/O, O/E evaluation for optical networks (PON/PDS)
- Testing SDH/ATM equipment and modules
- Testing cable modems for digital CATV
- R&D on TDMA
- R&D on wireless LAN peripherals
- Evaluating next-generation PC interfaces (fiber channel, IEEE 1394, SSA, ATM-25)
- Evaluating digital demodulators including QPSK/QAM, etc.
- Evaluating IrDA communications equipment
- Evaluating communications LSIs, ASICs/FPGAs, and CCDs, etc.

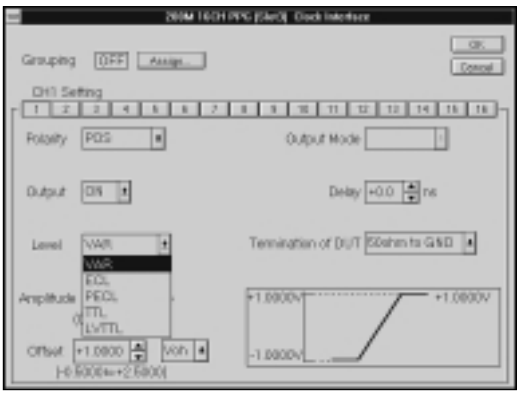
Performance and functions
• Simultaneous bit error measurement of 16 channels
The MP1630B has 16-channel Pulse Pattern Generator and Error Detector units and can measure bit errors in parallel and simultaneously. Using the MP1630B shortens the time required to measure each device to 1/N, thereby greatly improving production efficiency.

• For both continuous and burst data
Continuous data is used in the PDH/SDH transmission system; burst data is used in the PON (Passive Optical Network) subscriber TDMA transmission system, as well as in the burst cell unit ATM-PON transmission system. The MP1630B can handle bit error measurement of both continuous and burst data. It can output burst data for up to 16 channels, and the burst cycle, guard time, preamble length, and data length can all be varied.

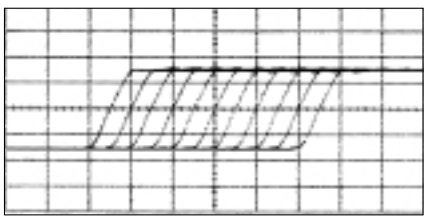
• Mixed pattern generation, selective BER measurement
With the MP1630B, a test pattern can be selected and set for each channel. Not only can both PRGM and PRBS patterns be used, but a mixed pattern composed of both PRGM and PRBS patterns can be generated, too. The packet type and cell type data can be configured smoothly from the overhead and payload parts. Moreover, the pattern field can split in two to 32 blocks, and a PRGM or PRBS pattern can be allocated to each column individually. As a result, it is possible to create pseudo-test signals for SDH/ATM, etc., as well as signals for evaluating complex communication protocols.

32 block mixed pattern setting screen

• Superior basic functions
A high-performance frequency synthesizer is built into the MP1630B. It generates stable, accurate signals with high resolution in the 10 kHz to 200 MHz band. In addition, when the optional digital modulator function is used, the jitter tolerance of communications equipment and devices can also be measured.
In addition to TTL, LVTTL, ECL, and PECL, the pulse pattern generator clock and data output levels can be set to any output (0.25 to 2.5 V at 50 Ω termination; 0.5 to 5.0 V at high) for a variety of interfaces. The data and clock output delay can be varied at high resolution for each channel, and there is no need to adjust the cable length for each signal.



Pulse pattern generator clock interface screen

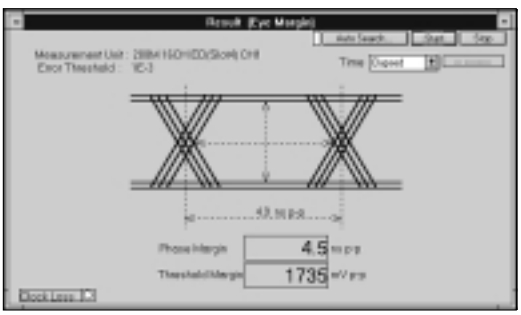


10 MHz (V: 800 mV/div, H: 2 ns/div)
Clock delay: –5 to +5 ns/1 ns steps (averaged waveform)

Variable delay characteristics

• Evaluating error correction function using burst error insertion
In addition to having the earlier cyclic and single error-mode insertion functions, the MP1630B has burst-mode insertion functions, making it ideal for evaluating the efficiency of error-correction codes used by each type of communication protocol. In particular, it is especially effective for testing digital transmission methods used by broadcast satellites and mobile phones, etc.

• Evaluating data waveform quality using eye margin measurement
The MP1630B eye margin measurement function can automatically measure the threshold voltage and phase range below the specified error rate. It has two measurement modes: the Margin mode and the Diagram mode. These modes can be selected according to the application.



Margin mode

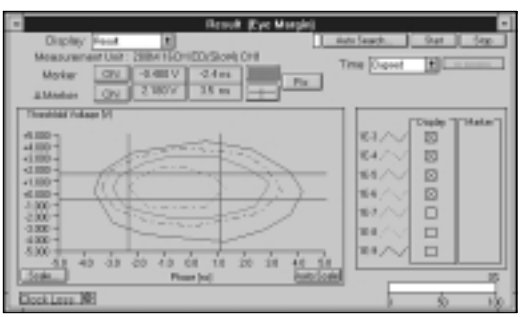
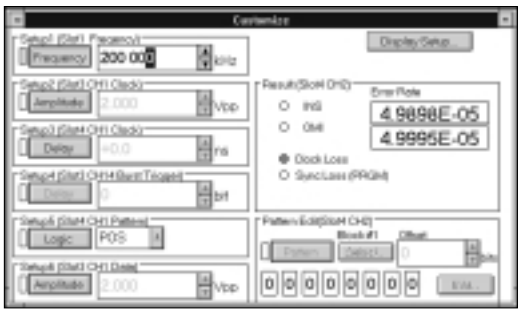


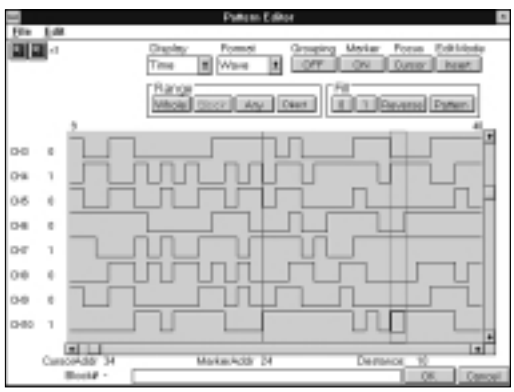
Diagram mode

• One-key/one-parameter operation using customized screens
Measurement of general multi-channel data requires complex operations to manage the large number of measurement parameters. To make measurement settings simpler, the MP1630B has convenient customized screens based on the one-key/one parameter operation used previously in the Anritsu BERTS. It also has a Grouping function which groups together the same measurement items used for each channel. Common settings (all or pattern-only) are saved as files on the large internal hard disk.



Customized screen

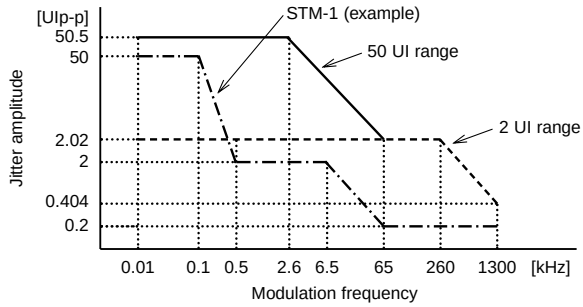
• Powerful pattern editor function
The MP1630B pulse pattern generator and error detector PRGM patterns can be edited easily using the keyboard, mouse, or cursor keys. There are three editing modes matching the various applications: Time, State, and Dump. The Time mode puts time on the horizontal axis and displays the pattern for each channel as a horizontal line. The State mode displays the data of channel 1 as the MSB and parallel 16 bits (corrected 1 bit from each channel at a time) as one data item. The Dump mode displays the pattern for the specified channel as a memory dump image using either binary or hexadecimal code.



Pattern editor (time mode, input waveform)

For product ordering information, see pages 4 – 10

Specifications

Clock	Internal Operating frequency: 10 kHz to 200 MHz (accuracy: ±2 ppm) Resolution: 1 kHz steps (>1 to 200 MHz), 100 Hz steps (10 kHz to 1 MHz) External Input frequency range: 10 kHz to 200 MHz Input level: AC, 0.5 to 2.0 Vp-p (50 Ω), BNC connector External (at locked) Input frequency range: 10 MHz ±100 ppm, 64 kHz ±100 ppm Input level: AC, 0.5 to 2.0 Vp-p (50 Ω), BNC connector
Jitter modulation function (option)	External modulation input Modulation frequency range: 10 Hz to 1.3 MHz Input level range (sine wave): –1 to +1 V (75 Ω), BNC connector Reference output (jitter-free output): AC, 1 Vp-p (50 Ω), SMA Jitter: 0 to 50.5 UIp-p (clock frequency: >100 to 200 MHz) ∗Switchable to 50 UI/2 UI range 
Test pattern (pulse pattern generator, error detector)	PRBS Pattern: 2^n – 1 (n: 7, 9, 11, 15, 20, 23, 31), variable mark ratio, logic selectable Zero substitution pattern: 2^n (n: 7, 9, 11, 15); pattern length: n to 2^n – 1, logic selectable PRGM pattern: 2 to 65,536 bits/channel bit length, logic selectable Mixed pattern: Mixed PRGM and PRBS pattern, logic selectable ∗Block numbers: 2 to 32 [PRGM bit length/block: 8 to 8,912 bits; PRBS bit length/block: 8 to 131,072 bits (depend on block numbers)] PON pattern [TDMA test patterns with preamble inserted in ahead of Mixed patterns (PRGM and PRBS)] Preamble (1010...): 0 to 64 bits; guard time: –2,097,083 to 2,097,067 bits (1 bit resolution) Burst mode: Internal (burst cycle: 0.1 to 10 ms), external (enable length: 8 to 2,097,144 bits) Pattern edit function Edit mode: Dump, timing diagram, state table Edit results storage: Internal HDD or FDD
Error insertion	Each channel, simultaneous or independently Error type: Normal, burst Normal mode (internal: cyclic or single, external) Error rate: 10^{-n} (n: 3 to 9) Insert area: Entire area, selected blocks (in Mixed pattern or PON pattern) Burst mode (internal/external) Error rate: 10^{-n} (n: 2 to 9) Internal enable length: 20 to 140 ms (resolution: 20 ms) Internal cycle: 1 to 10 s (resolution: 1 s) External mode: Error of specified rate inserted in external signal enable period
Data/clock output	Output No.: 16 (multipin connector), output on/off and logic selectable Output waveform: NRZ (data), RZ (clock) Output level: ECL, PECL, TTL, LVTTL, VAR VAR range Amplitude: 0.5 to 5 V (10 mV steps, high impedance), 0.25 to 2.5 V (5 mV steps, 50 Ω) Offset: –4.5 to + 5 V (5 mV steps, high impedance), –2.25 to + 2.5 V (2.5 mV steps, 50 Ω) Rise/fall times (typ.): 1.3 ns (1 Vp-p, 50 Ω termination) Clock delay: –5 to +5 ns (100 ps steps) Data skew: –5 to +5 ns (100 ps steps)
Data/clock input	Input No.: 16, logic selectable, multipin connector Input waveform: NRZ (data), RZ (clock) Input level: ECL, PECL, TTL, LVTTL, VAR VAR input range Amplitude: 0.5 to 5 V (50 Ω) Threshold level: –5 to + 5 V (5 mV steps, in 50 Ω to GND termination) Clock delay: –5 to +5 ns (100 ps steps)
Measurement data	Channel No.: 16 channels simultaneous measurement (selectable measurement channels) Signal format: Continuous or burst (internal/external)
Bit error measurement	Error detection: All, insertion, omission Measurement region: All, PRGM, PRBS selectable, and each block selectable with block configuration Display Error rate: 0 x 10^{-16} to 1.0000 x 10^{0} Error count: 0 to 9999999, 1.0000 x 10^{7} to 9.9999 x 10^{16} Error interval: 0 to 9999999, 1.0000 x 10^{7} to 9.9999 x 10^{16} Error free interval: 0.0000 to 100.0000% Error performance: ITU-T Rec. G.821 Measurement mode: Single, repeat, untimed (1 second to 99 days 23 hours 59 minutes 59 seconds) Auto sync: ON/OFF switchable [threshold value: 1 x 10^{-n} (n: 2 to 8)], with autosearch function
Alarm measurement	Detected items: Power loss, clock loss, pattern sync loss (PRGM, PRBS)

Continued on next page

Frequency measurement		Measurement range: 10 kHz to 200 MHz Effective digits: 6 digits Resolution: 100 Hz Accuracy: ± (1 count ±10 ppm)
Eye margin measurement (based on BER)		Measures eye margin or eye diagram of specified data (1 channel) Eye margin: Displays threshold margin and phase margin as numeric values Eye diagram: Displays width of eye aperture as two-dimensional graph using bit-error measurement
Delay measurement		Mode: Single/repeat Unit: Time/bit numbers Range Time: 0 to 999 µs (1 µs steps), 1 to 999 ms (1 ms steps), 1 to 10 s (1 s steps) Bits: 2^{31} bits (max.) Time out: 0.5, 1, 2, 5, 10 s
I/O signal for burst BER measurement	Pulse pattern generator	External burst input Level: TTL (H: Enable, L: Disable), BNC connector Burst trigger output (index signal for each burst data) Output No.: 16 (for each data output), bit delay function Level: ECL, –2 V (50 Ω), multipin connector Auxiliary output (PON system envelope, or AGC reset signal; usable as normal control signal) Output No.: 8 (selectable channel), 1 (OR output for each channel), bit delay function, logic selectable Level: ECL or TTL (≤100 Mb/s), multipin connector
	Error detector	Burst trigger input Input No.: 16 (for each data input) Level: ECL, –2 V (50 Ω), multipin connector
Other I/O signals		Sync signal output (pulse pattern generator, error detector) Sync source: 1/1 clock, 1/8 clock, PRGM pattern, PRBS pattern Level: 0/–1 V (50 Ω), BNC connector External error input (pulse pattern generator) Error mode: Normal, burst Level: TTL, BNC connector Trigger output (pulse pattern generator) Trigger source: Unique pattern index for delay measurement or pattern block index in MIX/PON pattern Level: 0/–1 V (50 Ω), multipin connector Trigger input (error detector) Trigger source: For delay measurement Level: 0/–1 V (50 Ω), multipin connector
System environment		Platform: Microsoft Windows operating system version 3.1 Display: Color LCD, touch screen, 640 x 480 dots, 256 colors Printer: Parallel port for printer, D-sub 25-pin connector Keyboard: 101 keys (English), PS2 mini-DIN 6-pin connector Mouse: Serial, PS2 mini-DIN 6-pin connector FDD: 2 mode (1.44 MB, 740 KB) HDD C drive: ≥1,380 MB (for measurement data, patterns) D drive: 30 MB (not released to user, interface: IDE)
Remote control		RS-232C (standard), GPIB (option): IEEE488.2, Ethernet (option): 10 Base-T
Other functions		Sound: When error or alarm detected, panel lock function, self check function
Power		100 to 120/200 to 240 Vac, 47.5 to 63 Hz, ≤1,000 VA
Dimensions and mass		426 (W) x 221.5 (H) x 451 (D) mm, ≤29 kg
Operating temperature		5˚ to 40˚C

The specifications are with the MU163000A (200M Clock Generator Unit), MU163020B (200M 16CH Pulse Pattern Generator Unit), and MU163040B (200M 16CH Error Detector Unit) installed in the MP1630B main frame.

For product ordering information, see pages 4 – 10

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MP1630B	Digital Data Analyzer	
	Standard accessories	
J0491	Power cord (shielded):	1 pc
F0087	Fuse, 10 A:	2 pcs
Z0319A	PS/2 mouse:	1 pc
Z0320	Input pen:	1 pc
Z0388	MP1630B recovery disk (only for MP1630B customer):	11 pc
Z0389	MP1630B application disk (only for MP1630B customer):	7 pc
Z0390	MP1630B remote sample disk (only for MP1630B customer):	1 pc
Z0396A	Pen holder:	1 pc
W1442AE	MP1630B operation manual:	1 copy
W1443AE	MP1630B remote control operation manual:	1 copy
W1450AE	MP1630B auto adjust operation manual:	1 copy
	Options	
MP1630B-01*1	GPIB (GPIB interface board)	
MP1630B-02*1	Ethernet (Ethernet interface board)	
	Peripherals	
Z0321A	Keyboard (PS/2)	
J0008	GPIB cable	
MB24B	Portable Test Rack (specified current: 10 A)	
B0348	Soft case	
B0329D	Front cover	
B0333D	Rack mount kit	
	Plug-in unit	
MU163000A*1	200M Clock Generator Unit	
	Standard accessories	
W1187AE	MU163000A operation manual:	1 copy
	Option	
MU163000A-01*1	Jitter addition	
	Peripherals	
J0776D	Coaxial cord (BNC-P-3W · 3D-2W · BNC-P-3W), 2 m (double shield)	
	Plug-in unit	
MU163020B*1, *2	200M 16CH Pulse Pattern Generator Unit	
	Standard accessories	
J0693B	SMA cable, 0.27 m:	2 pcs
W1444AE	MU163020B/163040B operation manual:	1 copy
	Peripherals	
J0776D	Coaxial cord (BNC-P-3W · 3D-2W · BNC-P-3W), 2 m (double shield)	
J0824	BNC multi-core cable, (16 pins), 1 m	
J0825	BNC multi-core cable, (9 pins), 1 m	
J0826	SMA multi-core cable, (16 pins), 1 m	
J0827	SMA multi-core cable, (9 pins), 1 m	
J0858	SMA multi-core cable, (16 pins), 2 m	
J0859	SMA multi-core cable, (9 pins), 2 m	
J0860	BNC multi-core cable, (16 pins), 2 m	
J0861	BNC multi-core cable, (9 pins), 2 m	

Model/Order No.	Name	
	Plug-in unit	
MU163040B*1, *2	200M 16CH Error Detector Unit	
	Standard accessories	
J0828	Multi-core cable, (16 pins), 0.5 m:	2 pcs
J0829	Multi-core cable, (17 pins), 0.5 m:	1 pc
J0693D	SMA cable, 0.27 m:	1 pc
W1444AE	MU163020B/163040B operation manual (not supplied when Pulse Pattern Generator Unit purchased at same time):	1 copy
	Peripherals	
J0776D	Coaxial cord (BNC-P-3W · 3D-2W · BNC-P-3W), 2 m (double shield)	
J0824	BNC multi-core cable (16 pins), 1 m	
J0825	BNC multi-core cable (9 pins), 1 m	
J0826	SMA multi-core cable (16 pins), 1 m	
J0827	SMA multi-core cable (9 pins), 1 m	
J0858	SMA multi-core cable (16 pins), 2 m	
J0859	SMA multi-core cable (9 pins), 2 m	
J0860	BNC multi-core cable (16 pins), 2 m	
J0861	BNC multi-core cable (9 pins), 2 m	

∗1: Factory option
∗2: Requires multi-core cable shown in peripherals (sold separately) for measurements

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Windows is an abbreviation for Microsoft Windows Operating System.
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DIGITAL DATA ANALYZER
MP1632C
50 MHz to 3.2 GHz

For Development, Manufacturing and Inspection of Transmission Systems, Optical Modules and Logic Devices

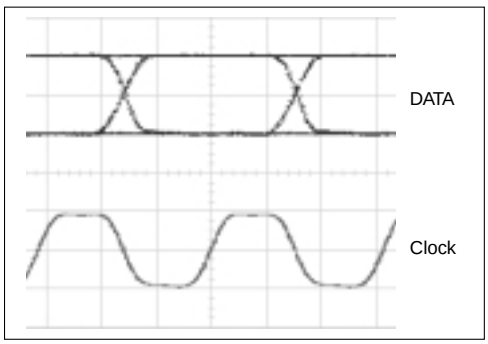
CE GPIB OPTION

Core networks and computer networks are increasing rapidly as the volume of data transmitted in this multimedia data is growing. In addition to the STM-16/OC-48 (2.488 Gbit/s), Fibre channel, Giga-bit Ethernet, etc. are being commercialized. Compact and high performance digital data analyzer are required for inspecting products like digital transmission systems, optical modules, and logic devices.
The MP1632C realizes a compact solution that incorporates former measuring equipment (MP1652A Pulse Pattern Generator and MP1653A Error Detector) into a case.
MX163201A TEXT to MP1632A/C Pattern Conversion Software, MX163202A MP165X to MP1632A/C Pattern Conversion Software, MX163205A Q and Eye Analysis Software, and MX163206A SDH/SONET Pattern Editor are available as application software.

Features
- 3.2 Gb/s PPG and ED in a case
- Eye diagram measurement and burst signal measurement supported

Performance and functions
• Easy operation
The MP1632C has a large, color LCD with touch screen. Microsoft Windows® operating system version 3.1 displays measurement results graphically. Customized screens enable one-key and one-parameter operation.

• High-quality pulse pattern generator
Programmable patterns of 8 Mbit max, PRBS patterns [(2^7 – 1) to (2^{31} – 1) with variable mark ratio], and zero substitution patterns can be generated. Variable cross-point of data output waveform is also supported.



H: 100 ps/div, V: 1 V/div
MU163220C output waveform (3.2 GHz)

• Error detector with many functions
High input sensitivity (25 mVp-p*) and wide phase margin (250 ps*) performance is provided. The autosearch function enables PRBS pattern search with usual phase and threshold search. Insertion error and omission error can be measured simultaneously.
*Typical values at 3 Gb/s, PRBS 2^{23} – 1

• Internal synthesizer with high signal purity (Option)
Highly pure signals, SSB phase noise characteristics of –85 dBc/Hz or less (10 kHz offset), is generated.

• Support of various applications
The MP1632C supports testing of SDH/SONET (STM-0, 1, 4, 16/OC-1, 3, 12, 48) devices and modules, research and development on WDM components, Fibre channels, Giga-bit Ethernet, evaluation of E/O and O/E module, GaAs IC, and high-speed ASIC/FPGAs

For product ordering information, see pages 4 – 10

Specifications

• MU163220C 3.2G Pulse Pattern Generator

Operating frequency	10 MHz to 3.2 GHz (50 MHz to 3.2 GHz when using MP1632C-03 3.2G Internal Synthesizer)
External clock input	0.5 to 2 Vp-p (<0.5 GHz: square wave, ≥0.5 GHz: square wave or sine wave, 50% duty cycle)
Generation pattern	Pseudo random pattern (PRBS) Pattern length: $2^n - 1$ (n: 7, 9, 11, 15, 20, 23, 31) Mark ratio: 1/2, 1/4, 1/8, 0/8, $\overline{1/2}$, 3/4, 7/8, 8/8 AND bit shift upon mark ratio setting: 1, 3 bits Data pattern Data length: 2 to 8,338,608 bits Zero substitution pattern Continuous 0 bit length: 1 to (pattern length – 1) bits Pattern length: 2^n (n: 7, 9, 11, 15) Error insertion Error ratio: 10^{-n} (n: 3, 4, 5, 6, 7, 8, 9), single error External error input: Provided
Data output	Number of outputs: 2 (DATA/$\overline{\text{DATA}}$, independent) Amplitude: 0.5 to 2 Vp-p (10 mV steps, setting error: ±15% or ±0.1 V, whichever is greater) Offset voltage V_{OH}: –2 to +2 V (at 2 Vp-p amplitude), –3.5 to +2 V (at 0.5 Vp-p amplitude) (5 mV steps, setting error: ±15% of offset voltage, ±0.1 V or ±15% of amplitude, whichever is the greatest) Display: V_{OH}, V_{TH}, and V_{OL} selectable Rise/fall time: ≤80 ps (10% to 90% of amplitude) Pattern jitter: ≤30 psp-p Waveform distortion: 10% or 0.1 V of amplitude, whichever is greater Load impedance: 50 Ω (with back termination) Connector: SMA DATA/$\overline{\text{DATA}}$ tracking: $\overline{\text{DATA}}$ amplitude and offset voltage can be set to same value as DATA. Crosspoint adjustment function: Provided
Clock output	Number of output: 2 (CLOCK/$\overline{\text{CLOCK}}$, independent) Amplitude: 0.5 to 2 Vp-p (10 mV steps, setting error: ±15% or ±0.1 V, whichever is greater) Offset voltage V_{OH} : –2 to +2 V (at 2 Vp-p amplitude), –3.5 to +2 V (at 0.5 Vp-p amplitude) (5 mV steps, setting error: ±15% of offset voltage, ±0.1 V or ±15% of amplitude, whichever is the greatest) Display: V_{OH}, V_{TH}, and V_{OL} selectable Rise/fall time: ≤80 ps (10% to 90% of amplitude) Load impedance: 50 Ω (with back termination) Connector: SMA Clock delay: –1 to +1 ns (2 ps steps)
External burst trigger input	Input level: 0/–1 V, connector: SMA
Internal burst signal	Burst cycle: 2 µs to 50 ms (1 µs steps), Enable length: 1 µs to 49.999 ms (1 µs steps)
Burst trigger output	Output level: 0/–1 V, connector: SMA
Sync signal output	Number of outputs: 1 (1/8 clock, variable pattern synchronization output selectable), Output level: 0/–1 V, Connector: SMA
Operating temperature	+5 to +45°C
Power	≤200 VA
Dimensions and mass	232 (W) x 49 (H) x 449 (D) mm, ≤4.5 kg

• MU163240C 3.2G Error Detector

Operating frequency	10 MHz to 3.2 GHz (50 MHz to 3.2 GHz when using MP1632C-03 3.2G Internal Synthesizer)
Data input	Input waveform: NRZ Input voltage: 0.5 to 4 Vp-p Variable threshold voltage: –4 to +4 V (1 mV steps) Termination: Connected to GND, –2 V or +3 V via 50 Ω Connector: SMA
Clock input	Input waveform: Square wave (<0.5 GHz), square wave or sine wave (≥0.5 GHz), duty: 50% Input amplitude: 0.5 to 4 Vp-p Variable input delay: –1 to +1 ns (2 ps steps) Polarity inversion: POS/NEG inversion selectable Termination: Connected to GND, –2 V or +3 V via 50 Ω Connector: SMA
Auto search function	Phase, threshold, phase & threshold, PRBS pattern (allowed if the mark ratio is between 1/8 and 7/8)
Receive pattern	Pseudo random pattern (PRBS) Pattern length: $2^n - 1$ (n: 7, 9, 11, 15, 20, 23, 31) Marker ratio: 1/2, 1/4, 1/8, 0/8, $\overline{1/2}$, 3/4, 7/8, 8/8 AND bit shift upon mark ratio setting: 1, 3 bits Data pattern Data length: 2 to 8,338,608 bits Zero substitution pattern Continuous 0 bit length: 1 to (pattern length – 1) bits Pattern length: 2^n (n: 7, 9, 11, 15)
Sync mode	Normal, frame
Sync threshold	AUTO or 10^{-n} (n: 2, 3, 4, 5, 6, 7, 8)
Error detection mode	Omission, insertion, total

Continued on next page

Measurement items	Error rate: 0.0000 x 10^{-16} to 1.0000 x 10^{0} Number of errors: 0 to 9.9999 x 10^{16} Error interval (async): 0 to 9999999 (Interval: 100 ms, 1 s) Error free interval (EFI): 0.0000 to 100.0000% Clock frequency: 0.01 to 3.2 GHz (resolution: 1 Hz, accuracy: 10 ppm ±1 kHz)
Eye margin measurement function	Provided
Error performance calculation function	Provided
Measurement channel mask	1 to 8 channels, each channel settable independently
Error output	Number of output: 1 (1/32 bit rate OR error), Output level: 0/–1, Connector: SMA
Sync signal output	Number of outputs: 1 (switchable among 1/8 clock, fixed pattern sync, sync gain output) Output level: 0/–1 V, Connector: SMA
Burst trigger input	Input level: 0/–1 V, connector: SMA
Operating temperature	+5˚ to +45˚C
Power	≤250 VA
Dimensions and mass	232 (W) x 54 (H) x 449 (D) mm, ≤5 kg

• MP1632C (Main frame)

System environment	OS: Microsoft Windows® operating system Version 3.1 Display: 10.4 inch, color LCD (touch screen), 640 x 480 dots, 256 colors Printer: Parallel port for external printer (D-sub, 25-pins) Keyboard: 101 type (English), PS/2 (mini DIN 6-pin connector) Mouse: Serial, PS/2 (mini DIN, 6-pin connector) FDD: 2 modes (1.44 MB, 740 KB) HDD C drive: ≥474 MB (used for system: measurement data, pattern), D drive: ≥30 MB (not accessible to users, interface: IDE)
Remote control	RS-232C (standard), GPIB (option): IEEE488.2, Ethernet (option): 10 Base-T
EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)
Power supply	100 to 120 Vac/200 to 240 Vac, 47.5 to 63 Hz, ≤150 VA
Operating temperature	+5˚ to +45˚C
Dimensions and mass	426 (W) x 221.5 (H) x 451(D) mm, ≤20 kg

• 3.2G internal synthesizer (Option 03)

Frequency range	50 MHz to 3.2 GHz (1 kHz steps)
Frequency accuracy	±2 ppm
SSB phase noise	≤–85 dBc/Hz (10 kHz offset, 1 kHz bandwidth)
Non-harmonic spurious	≤–60 dBc (limited to spurious 10 kHz or more distant from carrier frequency)
Reference lock range	10 MHz ±10 ppm
Power	≤50 VA
Mass	≤5 kg

• Eye diagram template (Option 20)

Required system	MP1632A
Function	Adding templates on the MP1632A's eye diagram result screen

• MX163201A TEXT to MP1632A/C Pattern Conversion Software

Required system	Computer: IBM-PC/AT or full compatible, OS: Windows 3.1/95/98, CPU: Pentium 133 MHz or higher, Memory: 32 MB or more, Hard disk space: 25 MB or more Display Resolution: 640 x 480 or more, Display colors: 256 or more FDD: 3.5-inch (1.44 MB)
Text file	A text file describing the program pattern in hex format (maximum number of characters in a line: 32696 bits including spaces and return characters)
MP1632A/C pattern data file (PTN)	All the MP1632A/C set data and patterns (file format for reading/writing on the MP1632A/C main screen)
MP1632A/C pattern clip file (PCP)	Only patterns (a file format that can be read or written in the MP1632A/C Pattern Editor)

• MX163202A MP165X to MP1632A/C Pattern Conversion Software

Required system	Computer: IBM-PC/AT or full compatible, OS: Windows 3.1/95/98, CPU: Pentium 133 MHz or higher, Memory: 32 MB or more, Hard disk space: 25 MB or more Display Resolution: 640 x 480 or more, Display colors: 256 or more FDD: 3.5-inch (1.2/1.44 MB)
Input file	MP165X program pattern files: MP165X's reading/writing and edit File name: T**.PTN (for pulse pattern generator), R**.PTN (for error detector)
Output file	MP1632A/C pattern data file (PTN): All the MP1632A/C set data and patterns (file format for reading/writing on the MP1632A/C main screen) MP1632A/C pattern clip file (PCP): Only patterns (File format that can be read or written in the MP1632A/C's pattern editor.)

Note: Since the FD format of MP165X is 1.2 MB, the PC must read 1.2 MB format FD.

For product ordering information, see pages 4 –10

• MX163205A Q and Eye Analysis Software

Required system	Computer: IBM-PC/AT or full compatible, OS: Windows 95/98/NT, CPU: Pentium 166 MHz or higher, Memory: 64 MB or more, Hard disk space: 100 MB or more, GPIB: National Instruments made GPIB interface (PCMCIA-GPIB or AT- GPIB/TNT series boards are recommended.) Display Resolution: 800 x 600 or more, Display colors: 256 or more ∗If two or more applications are running simultaneously, operation cannot be guaranteed.
Function	Measurement frequency: 1 to 3.2 GHz Measurement patterns: PRGM, PRBS 7, 9, 11, 15, 20, 23, 31 Pattern format: Continuous/burst (To be synchronized within 1 s) Eye margin measurement Measurement resolution (threshold): 1 to 10 mV (1 mV steps), Measurement resolution (phase): 2 to 10 ps (2 ps steps), Measurement rate: E-2 to E-15 Eye diagram measurement Measurement resolution (phase): 2 to 10 ps (2 ps steps) Measurement rate: E-2 to E-15 (actual measurement), E-3 to E-12 (estimate measurement) Display rate: E-2 to E-15 (actual measurement), E-2 to E-4915 (estimate measurement) Mask test judgment rate: E-2 to E-15 Q factor measurement Measurement style: Multiple measurements at fixed phase/phase vs. Q factor measurements Bit error rate range: Upper limit at E-3 to E-5, lower limit at E-7 to E-12 Minimum error count (measurement accuracy): 1, 10, 100, 1000 Vth shift width: Automatic, fixed (1 to 10 mV/1 mV steps)

• MX163206A SDH/SONET Pattern Editor

Required system	Computer: IBM-PC/AT or full compatible, CPU: Pentium 200 MHz or higher, OS: Windows 95/98/NT, Memory: 64 MB or more Display Resolution: 800 x 600 or more; Display colors: 256 or more FDD: 3.5-inch (1.44 MB), Hard disk space: 100 MB or more, GPIB: National Instruments made GPIB interface (PCMCIA-GPIB or AT-GPIB/TNT series boards are recommended.)
Functions	SDH/SONET pattern editor Mapping: STM-N (N = 1, 4c, 12c, 16c), STS-N SPE (N = 1, 3c, 12c, 48c) Pattern edit: Arbitrary editing of program patterns (PRBS pattern can be inserted in the payload.), time indication, table indication/edit Payload: Free format, ALL 0, ALL 1, PRBS $2^n - 1$ (n = 7, 9, 11, 15, 20, 20z, 23, 31) ∗Pattern repetition up to the length of all frames CID pattern: Available Frame repetition : Maximum 26 frames Alarm addition: Alarm addition conforming to SDH/SONET Standard ∗items: OOF/LOF, MS-AIS (L-AIS), MS-RDI (L-RDI), MS-REI (L-REI), HP-AIS (P-AIS), HP-REI (P-REI), HP-RDI (P-RDI) BIP error addition: Generates parity errors of B1, B2, and B3 B1, B2, and B3 calculation: Available Scramble: Available BIP correction: Available OH editor: Available

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Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MP1632C	Digital Data Analyzer	
	Standard accessories	
	Power cord (shielded):	1 pc
F0090	Fuse, 8 A:	2 pcs
Z0319A	PS/2 mouse:	1 pc
Z0320	Input pen:	1 pc
Z0347	Recovery disk∗1:	1 set
Z0393	Application disk∗1:	1 set
Z0395	Remote sample disk∗1:	1 set
Z0396A	Pen holder:	1 pc
W1859AE	MP1632C operation manual:	1 copy
W1860AE	MP1632C remote control operation manual:	1 copy
B0447B	Dummy unit for EXTENSION:	1 pc
	Options	
MP1632C-01	GPIB	
MP1632C-02	Ethernet	
MP1632C-03	3.2G internal synthesizer	
	Application software	
MX163201A	TEXT to MP1632A/C Pattern Conversion Software	
MX163202A	MP165X to MP1632A/C Pattern Conversion Software	
MX163205A	Q and Eye Analysis Software	
MX163206A	SDH/SONET Pattern Editor	

∗1: Only for MP1632C customer
∗2: Units are factory options (not user replaceable)
∗3: Not supplied when 3.2G pulse pattern generator purchased as same time

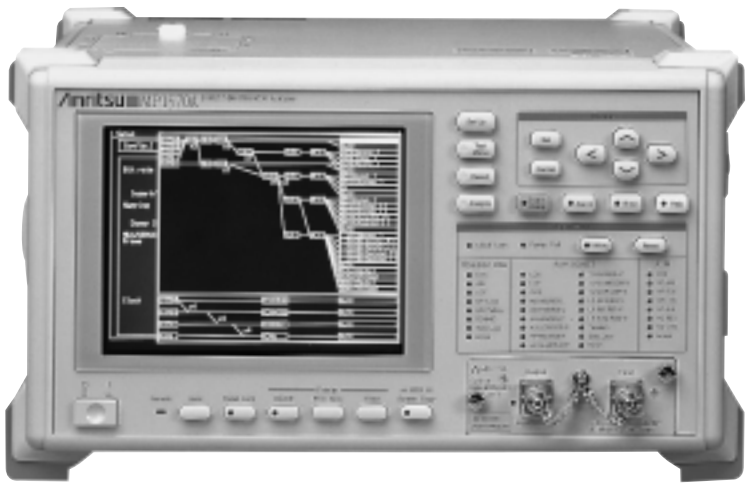
Model/Order No.	Name	
	Peripherals	
Z0321A	Keyboard (PS/2)	
J0008	GPIB cable, 2 m	
B0447A	Dummy unit for CG	
B0447C	Dummy unit for PPG	
B0447D	Dummy unit for ED	
Z0416	3.5 inch head cleaning disk	
MB24B	Portable Test Rack (specified current: 20 A)	
B0348	Soft case	
B0329D	Front cover	
B0333D	Rack mount kit	
J0905A	Semi-rigid cable (for Option 03)	
Z0398	Ethernet installation disk (for Option 02)	
W1529AE	Ethernet operation manual (for Option 02)	
MU163220C	3.2G Pulse Pattern Generator∗2	
	Standard accessories	
J0693A	Coaxial cord (HRM202B · 3D2W · HRM202B), 1 m:	1 pc
J0696A	Coaxial cord (AA-165-500), 0.5 m:	2 pcs
W1857AE	MU163220C/163240C operation manual:	1 copy
Z0306A	Wrist strap:	1 pc
MU163240C	3.2G Error Detector∗2	
	Standard accessories	
J0693A	Coaxial cord (HRM202B · 3D2W · HRM202B), 1 m:	1 pc
J0696A	Coaxial cord (AA-165-500), 0.5 m:	2 pcs
W1857AE	MU163220C/163240C operation manual∗3:	1 copy

SONET/SDH/PDH/ATM ANALYZER

MP1570A

1.5 Mbit/s to 10 Gbit/s

Comprehensive Testing of Core Networks from One Compact Portable Analyzer

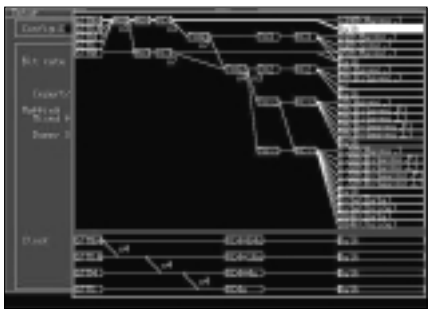


GPIB OPTION

The MP1570A analyzer is designed for development, manufacturing, construction, maintenance, and inspection of SDH, SONET, PDH, and ATM equipment and networks.
A variety of plug-in units and options are available that offer the flexibility to the users to configure various analysis systems for different applications.
The MP1570A is scalable from 1.5 Mbit/s to 10 Gbit/s, and has six slots to install the plug-in units required for SDH, SONET and PDH tests at bit different rates. Installing the appropriate combinations of plug-in units can also perform ATM, jitter and wander tests conform to ITU-T O.171/O.172.
The MP1570A conforms to the ITU-T recommendations and Bellcore standards, and supports concatenation mapping, tandem connection, APS measurement, CID measurement and POS measurement.
The user can measure 1.5 Mbit/s to 10 Gbit/s signals using a single MP1570A; previously, this required several measuring instruments.
The MP1570A has a built-in printer and a 3.5-inch floppy disk drive as standard output devices to print measurement results, and to save and read measurement data to and from the floppy disk (FD), which can also be read on an external PC. The user can also save screen data to the FD. The MP1570A has a "HELP" key function that explains operations, functions and connections.

SDH, SONET and PDH measurement

• Measurement at bit rates from 1.5 Mbit/s to 10 Gbit/s
A mapping route to a bit rate of up to 10 Gbit/s can be set.
The MP1570A mainly supports SDH, SONET, and Japanese mapping, European PDH and North American DSn for digital communications. For concatenation mapping, a route can be set from STM-1c/STS-3c up to STM-64c/STS-192c. Furthermore, the MP1570A supports a combination of channels. For example, 64 channels of VC4c/STS3c, 16 channels of VC4-4c/STS-12c, and four channels of VC4-16c/STS-48c (See Figure 1 or Figure 2 in page 154 or 155).



Mapping

• Overhead setting and testing
The user can modify and capture the overhead, and test the overhead portion with overhead change, pointer 64 frames, overhead add/drop and overhead bit errors.

• APS function
The user can test the automatic protection switch (APS) by measuring the equipment switching time accurately in milliseconds. The MP1570A also conforms to ITU-T Rec. G.783 and G.841.

APS test sub-screen

• Mixed payload
At mapping measurement in TUG-3 and AU3, the user can set different mapping for three additional channels other than the target measurement channel.

For product ordering information, see pages 4 – 10

• Tandem connection
The N1/Z5 and N2/Z6 bytes can be set and measured.

• Various analysis functions
The internal optical power meter and frequency counter allows the user to measure optical power and frequency during error and alarm measurement without changing the connections of the signal cables. The MP1570A can capture any SOH/TOH or POH (1 byte), K1/ K2 byte, or H1/H2 byte in 1023 frames to analyze errors and alarms, and check APS operation.
Measured errors and alarms can be displayed as a graph with a time scale in 1 second, 1 minute, 15 minutes, or 60 minutes.

• Pointer value monitoring
Changes in pointer value can be displayed as a graph with values updated in real time.

• MUX/DEMUX function (option)
When the MUX/DEMUX option is added, the multiplexing structure including the frame alignment signal can be generated, and multiplexer/demultiplexer measurement can be performed.

• Non frame pattern/CID pattern
Frames can be set on/off at all bit rates. CID pattern can generate or analysis at SONET/SDH measurements.

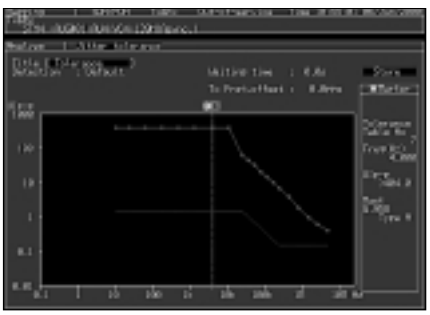
• Through modes
One of the three through modes can be selected: (1) Transparent, (2) Overhead/Overwrite, and (3) Payload/Overwrite. The external DS1/DS3/PDH signal can be added/dropped to/from payload at payload overwrite.

• Enhanced error/alarm simulation
The MP1570A can generate normal and abnormal frames alternately to test the frame synchronization function of terminal equipment. (This is an SDH/SONET FAS error addition function.)

• Easily operated pointer sequence test (combined jitter measurement)
Able to generate the justification pattern conforming to ITU-T G.783 from the transmission equipment side, and simultaneously make the tributary signal offset variable. This makes the combined jitter test possible.

Jitter, wander measurements (1.5 Mbit/s to 2.5 Gbit/s)

The jitter/wander measurement conforming to ITU-T O.171/O.172 exceeds these standards in performance evaluation. Automatic measurements, such as jitter tolerance, jitter transfer, and jitter vs. frequency offset are performed in a short time. Various automatic measurements can be achieved with just one unit.



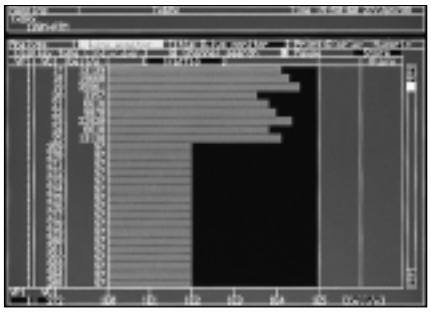
• Various wander generation functions (option)
Various wander generations for evaluation are available: such as TDEV wander tolerance measurement and TDEV wander transfer characteristics measurement that were regulated by ITU-T, ANSI, Bellcore, and ETSI.

• Wander measurement (option)
Subdivides the bandwidth of the wander measurement into three ranges, and can analyze the wander factor caused by temperature change, pointer, etc. It can also perform measurements conforming to ITU-T O.172.

• Through jitter function (only SONET/SDH)
Able to generate the jitter by through, while monitoring the input jitter quality.

ATM

• Supports ATM from 1.5M to 622M rates
TC layer mappings of 622M, 156M, 52M, 139M, 45M, 34M, 2M and 1.5M are supported along with ATM mappings of O.191, AAL1, AAL2, AAL3/4, and AAL5, which makes the MP1570A ideal for various combinations of layers. The VPI/VCI for 1023 channels can be detected automatically, and the presence/absence of alarms, cell count, and non-conforming cell count can be displayed graphically, for easy comparison of line channel traffic.



• 1- and 2-point CDV in conformance with I.356
When measuring delay in cell traffic, either 1-point CDV or 2-point CDV conforming to ITU-T Rec. I.356 can be selected according to the conditions.

• Simultaneous display of error cells, inserted error cells and lost cells
The error/alarm generation conditions can be displayed both numerically and graphically to give a visual impression of the traffic conditions.

• Traffic monitoring
The constantly changing traffic can be displayed as a graph for the selected-one-channel VPI/VCI.

IP-over-SONET/SDH, IP-over-ATM (option)

Programs IP/PPP at will transmits it, picks PPP packet from capture memory (option), displays it and supports high-speed POS router evaluation. And programs IP in the AAL5 payload at will transmits it, picks the IP packet from the cell capture memory, and displays it. And supports ATM router evaluation.

• IP/PPP header setting
Able to set the value of each header optionally when selecting IPv4 or IPv6. Calculates FCS or header checksum automatically.

• PPP packet transmission and real time count
Transmits the three types of packets (can be set separately) by optional sequence (the idle length between each packet can be set simultaneously.). Displays the number of Tx packets and Rx ppp packets at real time.

• PPP packet capture and display
Samples PPP packet from the capture memory, and displays IP header. Detects FCS error and displays it in red.

Specifications

• MP0121A 2/8/34/139/156M*1 Unit

Bit rate	2.048, 8.448, 34.368, 139.264 Mbit/s
Level/waveform	Conforms to ITU-T G.703 (with 20 dB monitoring point)
Connectors	BNC (75 Ω, unbalanced), 3-pin Siemens (120 Ω, balanced) 2.048 Mbit/s: HDB3 (balanced/unbalanced) 8.448, 34.368 Mbit/s: HDB3 (unbalanced) 139.264 Mbit/s: CMI (unbalanced)
Clock	Internal (accuracy: ±7 ppm, jitter unit not installed), external (ECL [AC] 50 Ω), received signal
Frame format	Unframed: 2, 8, 34, 139 Mbit/s Framed: 2 Mbit/s (with/without CRC-4 at channels 30/31, G.704), 8 Mbit/s (G.742), 34 Mbit/s (G.751), 139 Mbit/s (G.751), MUX/DEMUX (Option 06)
Test patterns	PRBS: $2^{11}-1$, $2^{15}-1$, $2^{20}-1$, $2^{23}-1$ (O.151) Invert: On/off Word: 16-bit programmable, all 0, all 1
Error addition	Bit (all, test pattern), code, E-bit Timing: Single, rate (1E–3, 1E–4, 1E–5, 1E–6, 1E–7) FAS: n in 16 (n: 1 to 4), all
Alarm addition	LOS, LOF, AIS, RDI, RDI (MF) Timing: All
Measurements	Mode: Single, repeat, manual In-service Errors: Frame, code, CRC-4, E-bit Alarms: Power-fail, LOS, AIS, LOF, MF loss, RDI, RDI (MF) Error performance: G.821 (inc. Annex D), M.2100, G.826 Out-of-service Errors: Frame, code, CRC-4, E-bit, bit Alarms: Power-fail, LOS, AIS, LOF, MF loss, RDI, RDI (MF), sync loss Error performance: G.821 (inc. Annex D), M.2100, G.826
LEDs	LOS, AIS, LOF, MF loss, RDI, RDI (MF), sync loss, errors
Monitor	Frame word
Trouble search	Auto search for errors/alarms in all measured channels
Delay measurement	0 to 1 s
Auxiliary interface	Clock sync output, frame sync output, error output

∗1: Built-in 156M CMI (electrical) interface

• MP0122A 1.5/45/52M*1 Unit, MP0122B 1.5/45/52/52M*2 (1.31) Unit

Bit rate	1.544, 44.736 Mbit/s
Level/waveform	1.544 Mbit/s: ANSI T1.102 (with 20 dB monitoring point), 0/655 ft 44.736 Mbit/s: ANSI T1.102 (with 20 dB monitoring point), 0/450/900 ft
Connectors	BNC (75 Ω, unbalanced), BANTAM (100 Ω, balanced) 1.544 Mbit/s: AMI/B8ZS (balanced), 44.736 Mbit/s: B3ZS (unbalanced)
Clock	Internal (accuracy: ±7 ppm, jitter unit not installed), external (ECL [AC] 50 Ω) received signal
Frame format	Unframed: 1.5, 45 Mbit/s Framed: 1.5 Mbit/s (D4, ESF, Japan ESF*3), 45 Mbit/s (M13, C-bit), MUX/DEMUX (Option 07)
Test patterns	PRBS: $2^{11}-1$, $2^{15}-1$, $2^{20}-1$ (zero suppress), $2^{20}-1$, $2^{23}-1$ (O.151) Invert: On/off Word: 16-bit program, all 0, all 1, 3 in 24 (1.5 Mbit/s)
Error addition	Bit (all, test pattern), code, parity, CRC-6, C-bit, REI Timing: Single, rate (1E–3, 1E–4, 1E–5, 1E–6, 1E–7) FAS (45 Mbit/s): n in 16 (n: 1 to 4), all
X-bit setting	00, 01, 10, 11
Alarm addition	LOS, LOF, AIS, RDI Timing: All
Measurements	Mode: Single, repeat, manual In-service Errors: FAS, code, parity, CRC-6, C-bit, REI Alarms: Power-fail, LOS, AIS, LOF, RDI Error performance: G.821 (inc. Annex D), M.2100, G.826 Out-of-service Errors: FAS, code, parity, CRC-6, C-bit, REI, bit Alarms: Power-fail, LOS, AIS, LOF, RDI, sync loss Error performance: G.821 (inc. Annex D), M.2100, G.826
LEDs	LOS, LOF, AIS, RDI, sync loss, errors
Trouble search	Auto search for errors/alarms in all measured channels
Delay measurement	0 to 1 s
Auxiliary interface	Clock sync output, frame sync output, error output

∗1: Built-in 52M B3ZS (electrical) interface
∗2: Built-in 52M B3ZS (electrical) and optical interfaces
∗3: Mounted Option 09 (Japan mapping)

For product ordering information, see pages 4 –10

• 52/156/622/2488/9953M (SDH)

Bit rate	51.84, 155.52, 622.08, 2488.32, 9953.28 Mbit/s
Level/waveform	52M (electrical: B3ZS)*1: ANSI T1.102, 0/450 ft 52M (optical): As per MP0122B unit optical interface specifications 156M (electrical: CMI)*2: ITU-T G.703 156M (optical): As per optical 156M/622M unit specifications 622M (electrical/optical): As per optical 156M/622M unit and NRZ unit specifications 2488M (electrical/optical): As per 2.5G unit and 2.5G/10G unit specifications 9953M (electrical/optical): As per 2.5G/10G unit specifications
Clock	Internal (accuracy: ±3.5 ppm, jitter unit not installed), Lock (2 MHz, 1.5 MHz, 64 kHz + 8 kHz, 2 Mbit/s, 1.5 Mbit/s), external (ECL [AC] 50 Ω, 9953M: 1.02 to 0.58 Vp-p, 50 Ω), received signal
Frame	SDH/SONET, CID pattern, non-frame
Mapping	See Fig. 1
Through	Trance parent, over head overwrite, payload overwrite
Test patterns	PRBS: $2^{11}-1$, $2^{15}-1$, $2^{20}-1$ (zero suppress, MP0122A/B installed), $2^{20}-1$, $2^{23}-1$, $2^{31}-1$ (only concatenation mapping 16c/64c, conform to O.151) Invert: On/off Word: 16-bit programmable, all 0, all 1
Error addition	Bit all (all, test pattern), FAS, B1, B2, B3, BIP-2, MS-REI, HP-REI, LP-REI Timing: Single, single (burst) bit (1 to 64000), rate (1E–3, 1E–4, 1E–5, 1E–6, 1E–7, 1E–8, 1E–9) User program AE-B [A: 1.0 to 9.9 (step: 0.1), B: 2 to 10] Alternative: Error frame (0 to 8000), normal frame (1 to 8000)
Alarm addition	LOS, LOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-SLM, HP-TIM, HP-RDI, HP-UNEQ, TU-AIS, TU-LOP, TU-LOM, LP-SLM, LP-TIM, LP-RDI, LP-UNEQ, LP-RFI Timing: Single, single (burst) frame Alternative: Alarm frame (0 to 8000), normal frame (1 to 8000), all
Measurements	Mode: Single, repeat, manual In-service/Out-of-service Errors: B1, B2, B3, BIP-2, MS-REI, HP-REI, LP-REI Alarms: Power-fail, LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-SLM, HP-TIM, HP-RDI, HP-UNEQ, TU-AIS, TU-LOP, TU-LOM, LP-SLM, LP-TIM, LP-RDI, LP-UNEQ, LP-RFI Error performance: G.826, M2101, M2110, M2120 Preset: Alarm measurement condition
LEDs	LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-RDI, HP-SLM, TU-AIS, TU-LOM, TU-LOP, LP-RDI, LP-RFI, LP-SLM, Tandem, sync. loss, errors
Tandem connection	N1 byte (Type 1, Type 2), N2 byte Errors: N2 BIP-2, TC-REI, OEI, IEC Alarms: VC-AIS, ISF, FAS, HP-Incoming-AIS, HP-TC-RDI, HP-ODI, LP-Incoming-AIS, LP-TC-RDI, LP-ODI
Justification	AU pointer, TU pointer, C, C1/C2 Measurement: NDF, +PJC, –PJC, Cons, C, C1/C2
Monitor	SOH, POH, K1/K2, pointer, path trace (TIM alarms detectable), Tandem, payload
Pointer sequence	Signal of opposites polarity, regular with double, regular with missing, double of opposites polarity, 87-3/26-1 (normal, add, cancel), continuous pattern (normal, add, cancel), single pointer adjustment, maximum rate pointer burst, phase transient pointer burst, initialize period polarity, cooldown period
Over head capture	SOH/POH (any 1 byte), H1/H2, K1/K2
Dummy channel setting	Payload: Dummy, copy, mixed payload Setting: POH, pathtrace, SS bit, Tandem
Simultaneous measurement	VC2, VC12, VC11
Trouble search	Auto search for errors/alarms in all measured channels
Delay	Measurement period: 0.5, 1, 2, 5, 10 s Measurement range: 0 to 999 µs, 1.0 to 999.9 ms, 1.0 to 10.0 s, time out Display accuracy: ±5 µs (0.5, 1 s), ±50 µs (2, 5, 10 s)
APS (K1/K2)	Switching time measurement Measurement range: 1 to 2000 ms, >2000 ms Trigger Internal: B1, B2, B3, BIP-2, MS-REI, HP-REI, LP-REI, MS-AIS, AU-AIS, AU-LOP, HP-RDI, TU-AIS, TU-LOM, TU-LOP, LP-RDI, LP-RFI, Bit External: Measures trigger input signal (active high) Threshold: Specify non-error alarm between 1 ms, 10 ms, 100 ms Sequence generation: 2 to 64 word, repeat (8000 frame) Sequence capture: 2 to 64 word, repeat (8000 frame)
Frequency measurement	Range: ±100 ppm, Accuracy: ±3.5 ppm (jitter unit not installed)
Over head test	OH change: SOH/POH 1 byte, K1/K2, RSOH, MSOH, SOH, POH (except B1, B2, B3, BIP-2) PTR 64 frame: AU pointer, TU pointer Timing: Single, repeat (2 to 64) Setting: PTR, NDF, +PJC, –PJC OH BERT: SOH/POH 1 byte (exclude B1, B2, B3, BIP-2), D1-D3, D4-D12 Test pattern: $2^{11}-1$, $2^{15}-1$ OH add/drop: SOH/POH 1 byte, D1-D3, D4-D12 (exclude B1, B2, B3, BIP-2 additional type)
Japan mapping (option 09)	VC11 Signaling (8-multiframe, 64-multiframe setting)
Frame memory/capture	Memory size: 64 frame (156M, 622M, Option 13), 64 frame (MU150008A-01/150009A-01/150010A-01, 2.5G), 26 frame (MU150000A-01, 2.5G/10G)
Insert/extract	Bit rate: 10G (52M, 156M), 2.5G (52M, 156M)
Payload offset	±100 ppm/0.1 ppm step
Auxiliary interface	Clock sync output, trigger input, trigger output, DCC interface (V.11), orderwire, receive clock output

*1: Mounted MP0122A/B, *2: Mounted MP0121A

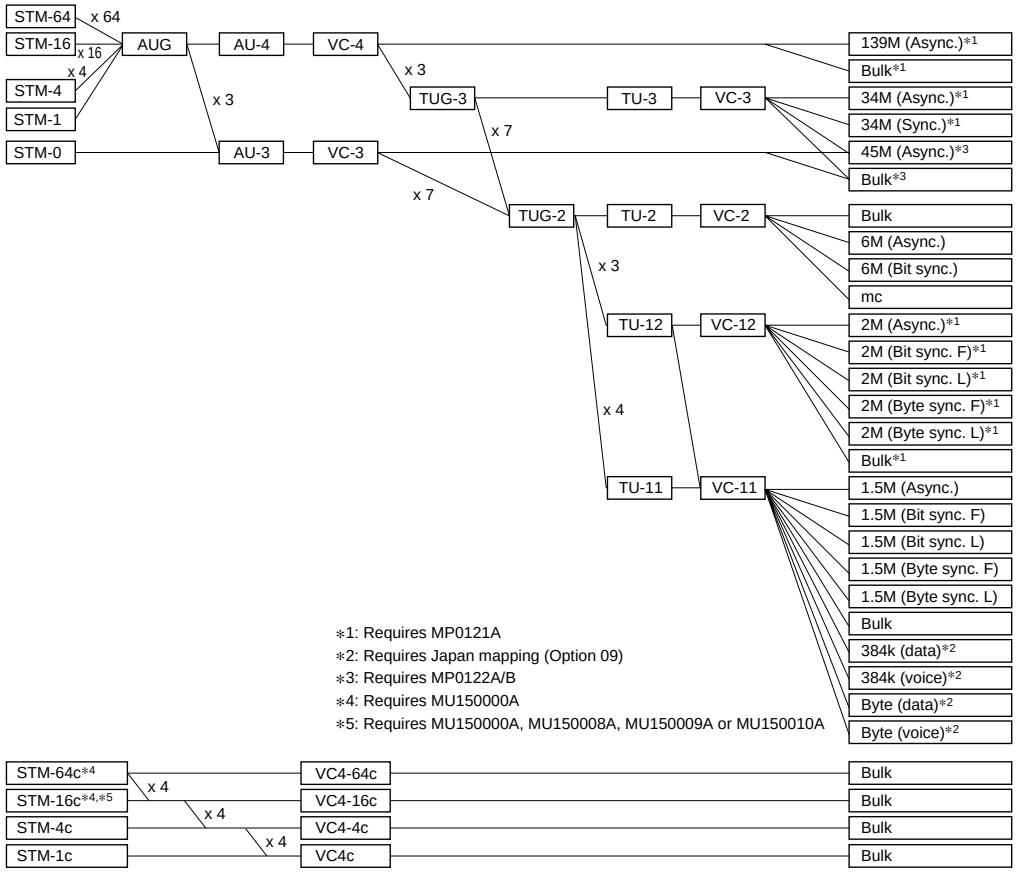


Fig. 1 Mapping structure (SDH)

- **52/156/622/2488/9953M (SONET)**

Bit rate	51.84, 155.52, 622.08, 2488.32, 9953.28 Mbit/s
Level/waveform	52M (electrical: B3ZS)*1: ANSI T1.102, 0/450 ft 52M (optical): As per MP0122B unit optical interface specifications 156M (electrical: CMI)*2: ITU-T G.703 156M (optical): As per optical 156M/622M unit specifications 622M (electrical/optical): As per optical 156M/622M unit and NRZ unit specifications 2488M (electrical/optical): As per 2.5G unit and 2.5G/10G unit specifications 9953M (electrical/optical): As per 2.5G/10G unit specifications
Clock	Internal (accuracy: ±3.5 ppm, jitter unit not installed), Lock (2 MHz, 1.5 MHz, 64 kHz + 8 kHz, 2 Mbit/s, 1.5 Mbit/s), External (ECL [AC] 50 Ω, 9953M: 1.02 to 0.58 Vp-p, 50 Ω), received signal
Frame	SDH/SONET, CID pattern, non-frame
Mapping	See Fig. 2
Through	Trance parent, over head overwrite, payload overwrite
Test patterns	PRBS: $2^{11}-1$, $2^{15}-1$, $2^{20}-1$ (zero suppress, MP0122A/B installed), $2^{20}-1$, $2^{23}-1$, $2^{31}-1$ (only concatenation mapping 16c/64c, conform to O.151) Invert: On/off Word: 16-bit programmable, all 0, all 1
Error addition	Bit all (all, test pattern), FAS, B1, B2, B3, BIP-2, REI-L, REI-P, REI-V Timing: Single, single (burst) bit (1 to 64000), rate (1E–3, 1E–4, 1E–5, 1E–6, 1E–7, 1E–8, 1E–9) User program AE-B [A: 1.0 to 9.9 (step: 0.1), B: 2 to 10] Alternative: Error frame (0 to 8000), normal frame (1 to 8000)
Alarm addition	LOS, LOF, AIS-L, RDI-L, AIS-P, LOP-P, PLM-P, HP-TIM, RDI-P, UNEQ-P, AIS-V, LOP-V, LOM-V, PLM-V, LP-TIM, RDI-V, UNEQ-V, RFI-V Timing: Single, single (burst) frame Alternative: alarm frame (0 to 8000), normal frame (1 to 8000), all
Measurements	Mode: Single, repeat, manual In-service/Out-of-service Errors: B1, B2, B3, BIP-2, REI-L, REI-P, REI-V Alarms: Power-fail, LOS, LOF, OOF, AIS-L, RDI-L, AIS-P, LOP-P, PLM-P, HP-TIM, RDI-P, UNEQ-P, AIS-V, LOP-V, LOM-V, PLM-V, LP-TIM, RDI-V, UNEQ-V, RFI-V Error performance: G.826, M2101, M2110, M2120 Preset: Alarm measurement condition
LEDs	LOS, LOF, OOF, AIS-L, RDI-L, AIS-P, LOP-P, RDI-P, PLM-P, AIS-V, LOM-V, LOP-V, RDI-V, RFI-V, PLM-V, Tandem, sync. loss, errors
Tandem connection	Z5 byte (Type 1, Type 2), Z6 byte Errors: Z6 BIP-2, TC-REI, OEI, IEC Alarms: VC-AIS, ISF, FAS, HP-Incoming-AIS, HP-TC-RDI, HP-ODI, LP-Incoming-AIS, LP-TC-RDI, LP-ODI

Continued on next page

Justification	STS pointer, VT pointer, C, C1/C2 Measurement: NDF, +PJC, –PJC, Cons, C, C1/C2
Monitor	TOH, POH, K1/K2, pointer, path trace (TIM alarms detectable), Tandem, payload
Pointer sequence	Signal of opposites polarity, regular with double, regular with missing, double of opposites polarity, 87-3/26-1 (normal, add, cancel), continuous pattern (normal, add, cancel), single pointer adjustment, maximum rate pointer burst, phase transient pointer burst, initialize period polarity, cooldown period
Over head capture	TOH/POH (any 1 byte), H1/H2, K1/K2
Dummy channel setting	Payload: Dummy, copy, mixed payload Setting: POH, pathtrace, SS bit, Tandem
Simultaneous measurement	VT6SPE, VT2SPE, VT1.5SPE
Trouble search	Auto search for errors/alarms in all measured channels
Delay	Measurement period: 0.5, 1, 2, 5, 10 s Measurement range: 0 to 999 µs, 1.0 to 999.9 ms, 1.0 to 10.0 s, time out Display accuracy: ±5 µs (0.5, 1 s), ±50 µs (2, 5, 10 s)
APS (K1/K2)	Switching time measurement Measurement range: 1 to 2000 ms, >2000 ms Trigger Internal: B1, B2, B3, BIP-2, REI-L, REI-P, REI-V, AIS-L, AIS-P, LOP-P, RDI-P, AIS-V, LOM-V, LOP-V, RDI-V, RFI-V, Bit External: Measures trigger input signal (active high) Threshold: Specify non-error alarm between 1 ms, 10 ms, 100 ms Sequence generation: 2 to 64 word, repeat (8000 frame) Sequence capture: 2 to 64 word, repeat (8000 frame)
Frequency measurement	Range: ±100 ppm, Accuracy: ±3.5 ppm (jitter unit not installed)
Over head test	OH change: TOH/POH 1 byte, K1/K2, LOH, SOH, TOH, POH (except B1, B2, B3, BIP-2) PTR 64 frame: STS pointer, VT pointer Timing: Single, repeat (2 to 64) Setting: PTR, NDF, +PJC, –PJC OH BERT: TOH/POH 1 byte (exclude B1, B2, B3, BIP-2), D1-D3, D4-D12 Test pattern: $2^{11} - 1$, $2^{15} - 1$ OH add/drop: TOH/POH 1 byte, D1-D3, D4-D12 (exclude B1, B2, B3, BIP-2 additional type)
Japan mapping (option 09)	VT1.5SPE Signaling (8-multiframe, 64-multiframe setting)
Frame memory/capture	Memory size: 64 frame (156M, 622M, Option 13), 64 frame (MU150008A-01/150009A-01/150010A-01, 2.5G), 26 frame (MU150000A-01, 2.5G/10G)
Insert/extract	Bit rate: 10G (52M, 156M, 622M), 2.5G (52M, 156M, 622M)
Payload offset	±100 ppm/0.1 ppm step
Auxiliary interface	Clock sync output, trigger input, trigger output, DCC interface (V.11), orderwire, receive clock output

∗1: Mounted MP0122A/B, ∗2: Mounted MP0121A

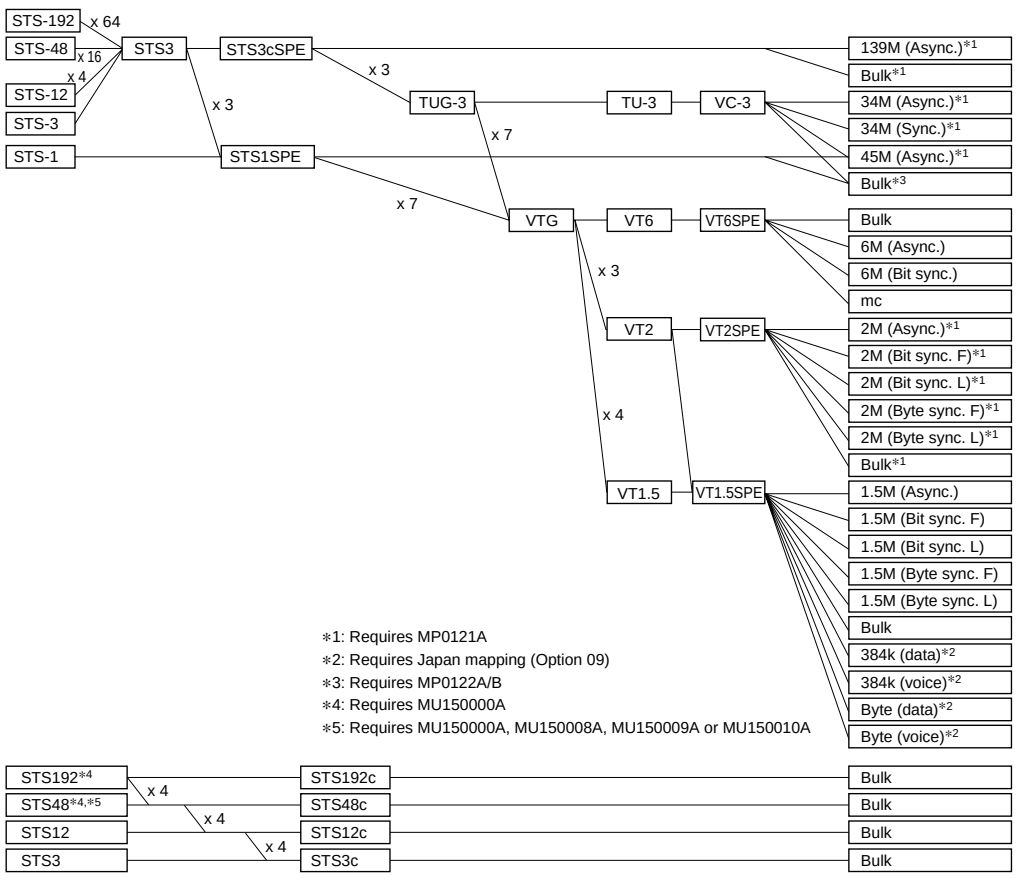


Fig. 2 Mapping structure (SONET)

• IP-over-SONET/SDH (Option)*1

Bit rate	155.52, 622.08, 2488.32, 9953.28 Mbit/s
PPP setting (RFC1662)	Flag, address, control: Any settable Protocol: 8/16 bit selectable and any settable FCS: 16/32 bit selectable and auto calculate Information: IPv4/IPv6 selectable and any settable
IPv4 setting (RFC0791)	Any setting: Version, IHL, TOS, total length, ID, flags, flagment offset, TTL, protocol, address (source, destination) Header checksum: Auto calculate Data byte: All 0, all 1, 8 bits program, single PRBS 7, user program (max. 65535 byte)
IPv6 setting (RFC1883)	Any setting: Version, priority, flow label, payload length, next header, hop limit, address (source, destination) Data byte: All 0, all 1, 8 bits program, single PRBS 7, user program (max. 65535 byte)
Packet transmission setting	1 to 3 in IP/PPP (independently), IP/PPP sending pattern, packet sending interval (max. 100000 bytes), single/repeat, sending on/off, scramble (X^{43} + 1) on/off, control escape auto insertion, FCS error insertion (single), number of packet count display
Packet receiving/analysis	PPP frame calculation (count), scramble (X^{43} + 1) on/off setting, automatic analysis of control escape. Frame/capture memory (option) required data captured into the capture memory (max. 64 frames*2), IPv4/IPv6 select, IP address filter set

∗1: The frame/capture memory (option) is required.
∗2: Maximum 26 frames at 2488/9953 Mbits when MU150000A is inserted.

• IP-over-ATM (Option)*1

Bit rate	155.52, 622.08 Mbit/s
AAL5 edit pattern	IPv4/IPv6 selectable
IPv4 setting (RFC0791)	Any setting: Version, IHL, TOS, total length, ID, flags, flagment offset, TTL, protocol, address (source, destination) Header checksum: Auto calculate Data byte: All 0, all 1, 8 bit program, single PRBS 7, user program (max. 65535 bytes)
IPv6 setting (RFC1883)	Any setting: Version, priority, flow label, payload length, next header, hop limit, address (source, destination) Data byte: All 0, all 1, 8 bits program, single PRBS 7, user program (max. 65535 bytes)
Packet sending	Follow with AAL5 distribution setting
Packet receiving/analysis	Displays the IP packet from the data captured into cell capture memory (maximum 2016 cells), IPv4/IPv6 selectable

∗1: MP0123A ATM Unit is required.

• General

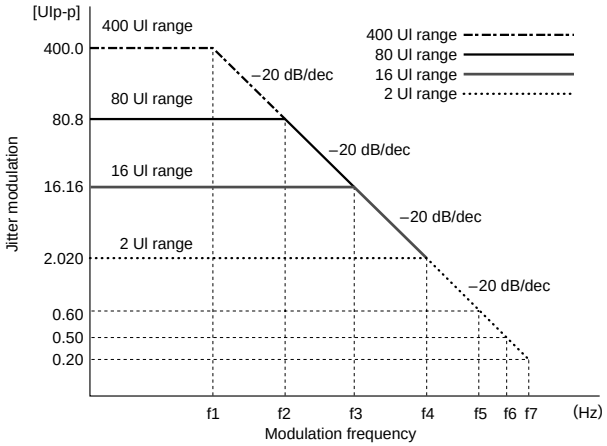
Printer	Internal, external
Internal memory	Measurement settings memory: 10, Graphics memory: 15
Others	FDD, RS-232C (Option 01)*1, GPIB (Option 02)*1, Ethernet (Option 03)*1, video output (Option 04)*1, buzzer, clock, help, screen copy
EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)
Dimensions and mass	320 (W) x 177 (H) x 350 (D) mm, 10 kg approx. (excluding plug-in units and options)
Power	100 to 240 Vac, 47.5 to 63 Hz, ≤500 VA
Temperature	0˚ to +40˚C

∗1: The video output, RS-232C, GPIB and Ethernet options cannot all be used simultaneously.
Only the video output + RS-232C, or video output + GPIB, or RS-232C + GPIB board, or Ethernet board combinations support simultaneous use, so change the board combinations according to the purpose.

For product ordering information, see pages 4 – 10

• MU150005A/150006A/150007A Jitter Units

Bit rate	MU150005A: 2.048, 8.448, 34.368, 139.264, 155.52, 622.08 Mbit/s MU150006A: 1.544, 44.736, 51.84, 155.52, 622.08 Mbit/s MU150007A: 1.544, 2.048, 8.448, 34.368, 44.736, 139.264, 51.84, 155.52, 622.08 Mbit/s
Jitter generation	Conform to ITU-T O.171/O.172 Modulation frequency: 0.1 Hz to 6 MHz Amplitude: 0 to 404.0 UIp-p Resolution:0.001 UIp-p (2 UI range), 0.01 UIp-p (16 UI range), 0.1 UIp-p (80 UI range), 0.2 UIp-p (400 UI range)



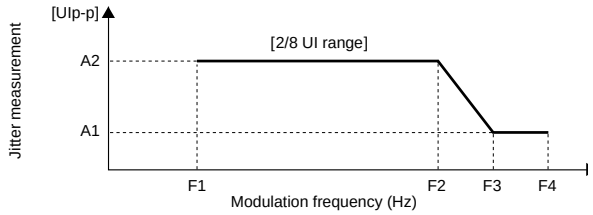
Bit rate (Mbit/s)	f1 (Hz)	f2 (Hz)	f3 (kHz)	f4 (kHz)	f5 (kHz)	f6 (kHz)	f7 (kHz)
1.544	130	630	3.2	25	—	100	—
2.048	300	1.5k	7.5	60	—	240	—
8.448	1.1k	5.5k	28	220	—	880	—
34.368	2.5k	13k	63	500	—	—	5000
44.736	2.5k	13k	63	500	—	—	5000
139.264	9k	45k	230	1800	6000	—	—
51.84	2.5k	13k	63	500	—	—	5000
155.52	7.5k	38k	190	1500	—	6000	—
622.08	3k	15k	75	600	—	—	6000

Accuracy
2 UI range: (±Q% of setting) ±0.02 UIp-p, 16 UI range: (±Q% of setting) ±0.2 UIp-p, 80 UI range: (±Q% of setting) ±1.2 UIp-p, 400 UI range: (±Q% of setting) ±6 UIp-p

Bit rate (Mbit/s)	Error Q	Frequency range
1.544	±12%	0.1 to 2 Hz
	±8%	2 Hz to 100 kHz
2.048	±12%	0.1 to 10 Hz
	±8%	10 Hz to 240 kHz
8.448	±12%	0.1 to 20 Hz
	±8%	20 Hz to 880 kHz
34.368	±12%	0.1 to 100 Hz
	±8%	0.1 to 500 kHz
	±12%	500 kHz to 5 MHz
44.736	±12%	0.1 to 2 Hz
	±8%	2 Hz to 5 MHz
139.264	±12%	0.1 to 100 Hz
	±8%	0.1 to 500 kHz
	±12%	0.5 to 2 MHz
	±15%	2 to 6 MHz
51.84	±12%	0.1 to 300 Hz
	±8%	300 Hz to 5 MHz
155.52	±12%	0.1 to 500 Hz
	±8%	0.5 to 500 kHz
	±12%	0.5 to 6 MHz
622.08	±12%	0.1 Hz to 1 kHz
	±8%	1 to 500 kHz
	±12%	0.5 to 2 MHz
	±15%	2 to 6 MHz

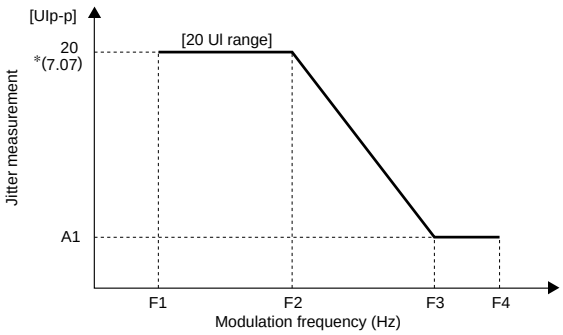
Continued on next page

Frequency offset	Range: ±999.9 ppm/0.1 ppm steps (jitter off), ±100 ppm/0.1 ppm steps (jitter on/off) Accuracy: ±0.1 ppm after power-on, calibrates after 60 min warm-up, 23˚ ±5˚C
Auxiliary interface	External modulation input, External 5/10 MHz reference input, Jitter clock/Jitter reference output, Wander reference output
Jitter measurement	Conform to ITU-T O.171/O.172 Modulation frequency: 0.1 Hz to 5 MHz Amplitude: 0.0 to 400 UI (800 UI: at 622M) Resolution: 0.001 UIp-p/0.001 UIrms (2 UI range), 0.01 UIp-p/0.01 UIrms (8 UI/20 UI range), 0.2 UIp-p (400 UI range), 0.5 UIp-p (800 UI range)



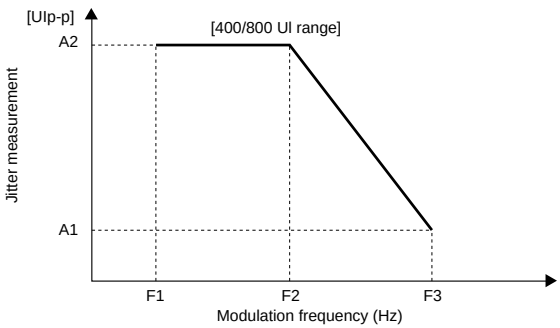
Bit rate (Mbit/s)	A1 (UIp-p)	A2 (UIp-p)		F1* (Hz)		F2 (Hz)		F3 (Hz)	F4 (Hz)
	—	Full	Wide	Full	Wide	Full	Wide	—	—
1.544	0.5	8	2	0.1	10	1.25k	5k	20k	40k
2.048	0.5	8	2	0.1	10	3.75k	15k	60k	100k
8.448	0.5	—	2	—	10	—	50k	200k	400k
34.368	0.5	8	2	0.1	10	18.75k	75k	300k	800k
44.736	0.5	8	2	0.1	10	25k	100k	400k	400k
139.264	0.5	8	2	0.1	10	50k	200k	800k	3.5M
51.84	0.5	8	2	1	10	25k	100k	400k	400k
155.52	0.4	8	2	1	10	25k	100k	500k	1.3M
622.08	0.3	8	2	1	10	75k	300k	2M	5M

*F1 = 100 Hz at RMS



Bit rate (Mbit/s)	A1 (UIp-p)	F1* (Hz)		F2 (Hz)	F3 (Hz)	F4 (Hz)
	—	Full	Wide	—	—	—
1.544	0.67	0.1	1	600	15k	15k
2.048	1.67	0.1	1	1.5k	18k	18k
8.448	1.43	0.1	1	5k	70k	70k
34.368	0.5	0.1	1	8k	300k	300k
44.736	0.5	0.1	1	10k	400k	400k
139.264	0.5	0.1	1	20k	800k	1.2M
51.84	0.5	1	1	10k	400k	400k
155.52	0.4	1	1	10k	500k	1.3M
622.08	0.3	1	1	30k	2M	5M

*F1 = 100 Hz at RMS



Bit rate (Mbit/s)	A1 (UIp-p)	A2 (UIp-p)	F1** (Hz)	F2 (Hz)	F3 (Hz)
1.544	20	400	0.1	10	200
2.048	20	400	0.1	10	200
8.448	20	400	0.1	10	200
34.368	20	400	0.1	10	200
44.736	20	400	0.1	10	200
139.264	20	400	0.1	10	200
51.84	20	400	0.1	10	200
155.52	4	400	0.1	10	1k
622.08	4	800	0.1	10	2k

**: Full band only

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Jitter measurement

Filter:
Conform to O.171/O.172, LP, HP0 + LP, HP1 + LP, HP2 + LP, HP + LP, user

Bit rate (Mbit/s)	HP0 (Hz)	HP1 (Hz)	HP2 (Hz)	HP2' (Hz)	HP (Hz)	LP (Hz)
1.544	10	10	8k	—	12k	40k
2.048	10	20	18k	700	12k	100k
8.448	10	20	3k	80k	12k	400k
34.368	10	100	10k	—	12k	800k
44.736	10	10	30k	—	12k	400k
139.264	10	200	10k	—	12k	3.5M
51.84	10	100	20k	—	12k	400k
155.52	10	500	65k	—	12k	1.3M
622.08	10	1k	250k	—	12k	5M

Accuracy (UIp-p, UI+p, UI-p)
2 UI range: ±R% of reading ±W UIp-p, 20 UI range: ±R% of reading ±W UIp-p, 400 UI range: ±R% of reading ±W UIp-p, 800 UI range: ±R% of reading ±W UIp-p

Fixed error [W]
UIp-p

Bit rate (Mbit/s)	Pseudo-random signal							
	HP1 + LP				HP2 + LP			Bit length
	2 UI	8 UI	20 UI	400/800 UI	2 UI	8 UI	20 UI	
1.544	0.040	0.08	0.22	3.5	0.025	0.05	0.15	$2^{20}-1$
2.048	0.040	0.08	0.22	3.5	0.025	0.05	0.15	$2^{15}-1$
8.448	0.040	—	0.22	3.5	0.025	—	0.15	$2^{15}-1$
34.368	0.040	0.08	0.22	3.5	0.025	0.05	0.15	$2^{23}-1$
44.736	0.040	0.08	0.22	3.5	0.025	0.05	0.15	$2^{15}-1$
139.264	0.040	0.08	0.30	5.0	0.025	0.05	0.15	$2^{23}-1$

Bit rate (Mbit/s)	Clock signal						
	HP1 + LP				HP2 + LP		
	2 UI	8 UI	20 UI	400/800 UI	2 UI	8 UI	20 UI
1.544	0.015	0.03	0.10	1.6	0.010	0.02	0.08
2.048	0.015	0.03	0.10	1.6	0.010	0.02	0.08
8.448	0.015	—	0.10	1.6	0.010	—	0.08
34.368	0.030	0.06	0.18	2.8	0.020	0.04	0.15
44.736	0.030	0.06	0.18	2.8	0.020	0.04	0.15
139.264	0.030	0.06	0.22	3.8	0.020	0.04	0.20

Bit rate (Mbit/s)	SONET/SDH signal							
	HP1 + LP				HP2 + LP			Container
	2 UI	8 UI	20 UI	400/800 UI	2 UI	8 UI	20 UI	
51.84e	0.070	0.14	0.30	5.0	0.050	0.10	0.20	VC3
51.84o	0.070	0.14	0.30	5.0	0.050	0.10	0.20	VC3
155.52e	0.070	0.14	0.30	5.0	0.025	0.05	0.20	VC4
155.52o	0.070	0.14	0.30	5.0	0.050	0.10	0.20	VC4
622.08	0.100	0.20	0.30	10.0	0.050	0.10	0.20	VC4-4c

At PRBS $2^{23}-1$

Bit rate (Mbit/s)	Clock signal						
	HP1 + LP				HP2 + LP		
	2 UI	8 UI	20 UI	400/800 UI	2 UI	8 UI	20 UI
51.84e	0.050	0.10	0.22	3.8	0.030	0.06	0.20
155.52e	0.050	0.10	0.22	3.8	0.030	0.06	0.20
622.08	0.050	0.10	0.22	5.0	0.030	0.06	0.20

Frequency error [R]

Frequency error	Frequency range
±10%	0.1 to 20 Hz
±7%	20 Hz to 300 kHz
±8%	300 kHz to 1 MHz
±10%	1 to 3 MHz
±15%	3 to 5 MHz

Continued on next page

Jitter measurement

UIrms
2 UI range: ±R% ±Y UIrms, 20 UI range: ±R% ±Y UIrms

Fixed error [Y]
UIrms

Bit rate (Mbit/s)	Pseudo-random signal			
	HP + LP			Bit length
	2 UI	8 UI	20 UI	
1.544	0.006	0.02	0.04	$2^{20} - 1$
2.048	0.006	0.02	0.04	$2^{15} - 1$
8.448	0.006	—	0.04	$2^{15} - 1$
34.368	0.008	0.02	0.05	$2^{23} - 1$
44.736	0.008	0.02	0.05	$2^{15} - 1$
139.264	0.008	0.02	0.05	$2^{23} - 1$

Bit rate (Mbit/s)	Clock signal		
	HP + LP		
	2 UI	8 UI	20 UI
1.544	0.004	0.02	0.03
2.048	0.004	0.02	0.03
8.448	0.004	—	0.03
34.368	0.006	0.02	0.04
44.736	0.006	0.02	0.04
139.264	0.006	0.02	0.04

Bit rate (Mbit/s)	SONET/SDH signal			
	HP + LP			Container
	2 UI	8 UI	20 UI	
51.84e	0.010	0.02	0.06	VC3
51.84o	0.010	0.02	0.06	VC3
155.52e	0.010	0.02	0.06	VC4
155.52o	0.010	0.02	0.06	VC4
622.08	0.012	0.03	0.08	VC4-4c

Bit rate (Mbit/s)	Clock signal		
	HP + LP		
	2 UI	8 UI	20 UI
51.84e	0.008	0.02	0.05
155.52e	0.008	0.02	0.05
622.08	0.010	0.02	0.06

At PRBS $2^{23} - 1$

Frequency error [R]

Frequency error	Frequency range
±10%	0.1 to 20 Hz
±7%	20 Hz to 300 kHz
±8%	300 kHz to 1 MHz
±10%	1 to 3 MHz
±15%	3 to 5 MHz

Hit measurement

Count, seconds, % free Seconds

Frequency measurement

Resolution: 0.1 ppm, Display: Hz or ppm (After power-on, calibrates after 60 min warm-up, 23˚ ±5˚C)

Auxiliary interface

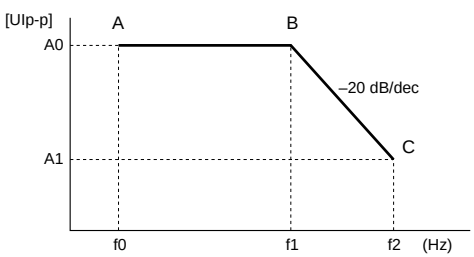
Demodulation output, Clock/Reference input

Jitter auto measurement

Jitter tolerance measurement: Evaluates jitter tolerance point automatically
Jitter sweep measurement: Conforms to high-speed jitter tolerance evaluation for mass production, etc.
Jitter transfer measurement: High dynamic range measurement by selective level method (variable)
Jitter frequency measurement: Measures the mapping jitter automatically
Frequency sweep measurement: Measures the jitter tolerance automatically while changing the offset

Line wander generation

Modulation frequency: 10 µHz to 10 Hz (sine wave)
Amplitude: 0 to 400,000 UI (10 UIp-p steps)



Bit rate (Mbit/s)	f0 (µHz)	f1 (mHz)	f2 (Hz)	A0 (UIp-p)	A1 (UIp-p)
1.544	10	20	10	400,000	800
2.048	10	20	10	400,000	800
8.448	10	200	10	400,000	8,000
34.368	10	400	10	400,000	16,000
44.736	10	400	10	400,000	16,000
139.264	10	2,000	10	400,000	80,000
51.84	10	400	10	400,000	16,000
155.52	10	2,000	10	400,000	80,000
622.08	10	400	10	400,000	16,000

Accuracy: ±Q% of setting ±100 UIp-p

Error Q	Frequency range
±8%	10 µHz to 0.125 Hz
±12%	0.125 Hz to 1 Hz
±15%	1 to 10 Hz

Wander auto measurement

Automatically evaluates the wander of the sine wave by the wander sweep measurement

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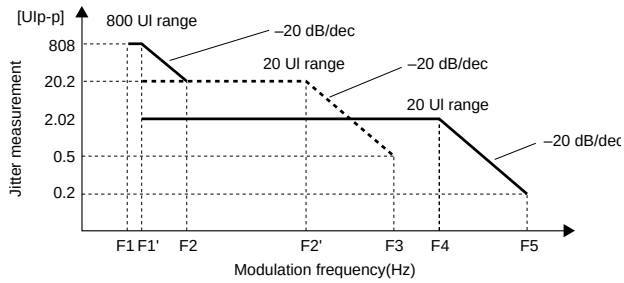
Reference wander generation (Option 03)	Off: Able to set non-modulated status TDEV mask: The 37 types of TDEV masks that are regulated by ITU-T, ETSI, ANSI, and Bellcore standards are available as default. It is possible to add the wander modulation on the user specified TDEV mask. Transient: It is possible to change the A $(1 - e^{-63.7t})$ phase by the timing of the start. Signal off: It is possible to disconnect the standard signal.
Wander measurement (Option 02)	Conform to ITU-T O.172 Reference input: 2.048M (HDB3, Clock), 1.544M (AMI/B8ZS, Clock), 64k + 8 kHz, 5 MHz, 10 MHz Sampling frequency: 40 Hz, 1 Hz, 0.1 Hz, 5 mHz (select by MX150001B) Measurement range P-P: 0.0 to 2E10 ns, +P/–P: 0.0 to 1E10 ns, TIE: 0.0 to ±1E10 ns Accuracy: Conform to ITU-T O.172 Measurement time: 10 to 1 x 10^8 s (max. 120, 000 s; MP1570A only) Wander application (requires MX150001B Wander Application Software) TIE: Max. 1 x 10^8 s, MTIE: Max. 1 x 10^8 s, TDEV: Max. 1 x 10^6 s Frequency offset: Measurement conforms to ANSI TI.105.09 Frequency drift rate: Measurement conforms to ANSI TI.105.09 MRTIE: The evaluation separated from the wander by a frequency offset Wander tolerance (TDEV) measurement: Evaluation by the various TDEV mask generations Wander transfer (TDEV) measurement: Calibration method by simulation,outputting results by the one measurement

• MU150011A 2.5G Jitter Unit

Jitter generation

Conforms to ITU-T O.172
Frequency: 2488.32 MHz
Modulation frequency: 0.1 Hz to 20 MHz
Amplitude: 0 to 808.0 UIp-p
Resolution: 0.001 UIp-p (2 UI range), 0.01 UIp-p (20 UI range), 0.4 UIp-p (800 UI range)



Bit rate (Mbit/s)	F1 (Hz)	F1' (Hz)	F2* (kHz)	F2'* (kHz)	F3* (MHz)	F4* (MHz)	F5* (MHz)
2488.32	0.1	60	2.5	30	1.2	2	20

*Typical value

Accuracy
2 UI range: (±Q% of setting) ±0.02 UIp-p, 20 UI range: (±Q% of setting) ±0.3 UIp-p, 800 UI range: (±Q% of setting) ±12.5 UIp-p

Bit rate (Mbit/s)	Error Q	Frequency range
2488.32	±12%	0.1 Hz to 5 kHz
	±8%	5 to 500 kHz
	±12%	0.5 to 2 MHz
	±15%	2 to 20 MHz

Frequency offset

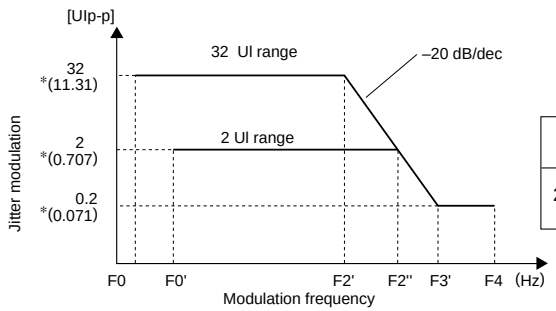
Range: ±100 ppm/0.1 ppm steps (jitter on/off)
Accuracy: ±0.1 ppm (after power-on, calibrate after 60 min warm-up, 23˚±5 ˚C)

Auxiliary interface

External clock input, Jitter reference output

Jitter measurement

Conforms to ITU-T O.172
Frequency: 2488.32 MHz ±100 ppm
Modulation frequency: 10 Hz to 20 MHz
Amplitude: 0.0 to 32 UI
Resolution: 0.001 UIp-p/0.001 UIrms (2 UI range), 0.01 UIp-p/0.01 UIrms (32 UI range)



Bit rate (Mbit/s)		F0 (Hz)	F0' (Hz)	F2' (kHz)	F2'' (kHz)	F3' (MHz)	F4 (MHz)
2488.32	2 UI	–	100	–	100	1	20
	32 UI	10	–	6.25	–	1	20

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Jitter measurement

Conforms to ITU-T O.172
LP, HP0 + LP, HP1 + LP, HP2 + LP, HP + LP

Bit rate (Mbit/s)	HP0 (Hz)	HP1 (Hz)	HP2 (Hz)	HP (Hz)	LP (Hz)
2488.32	10	5k	1M	12k	20M

Accuracy (UIp-p, UI+p, UI–p)
2 UI range: Measurement value ±R% ±W UIp-p, 32 UI range: Measurement value ±R% ±W UIp-p
[MU150008A/150009A/150010A are simultaneously installed, conform to ITU-T O.172]

Fixed error [W]
Input level: –12 to –10 dBm (adds to 0.01 UIp-p/dB at <–12 dBm)

Bit rate (Mbit/s)	SONET/SDH signal				
	HP1 + LP		HP2 + LP		Container
	2 UI	32 UI	2 UI	32 UI	
2488.32	0.100	2.2	0.050	1.40	VC4-16c

Bit rate (Mbit/s)	Clock signal			
	HP1 + LP		HP2 + LP	
	2 UI	32 UI	2 UI	32 UI
2488.32	0.050	0.60	0.030	0.50

At PRBS $2^{23} – 1$

Accuracy (UIrms)
2 UI range: ±R% ±Y UIrms, 32 UI range: ±R% ±Y UIrms

Fixed error [Y]
Input level: –12 to –10 dBm (adds to 0.002 UIrms/dB at <–12 dBm)

Bit rate (Mbit/s)	SONET/SDH signal			Clock signal	
	HP + LP		Container	HP + LP	
	2 UI	32 UI		2 UI	32 UI
2488.32	0.012	0.08	VC4-16c	0.010	0.16

At PRBS $2^{23} – 1$

Frequency error [R]

Frequency error	Frequency range
±7%	5 to 300 kHz
±8%	300 kHz to 1 MHz
±10%	1 to 3 MHz
±15%	3 to 10 MHz
±20%	10 to 20 MHz

Hit measurement

Count, Seconds, % free seconds

Frequency measurement

Resolution: 0.1 ppm, Display: Hz or ppm (after power-on, calibrates after 60 min warm-up, 23˚ ±5˚C)

Auxiliary interface

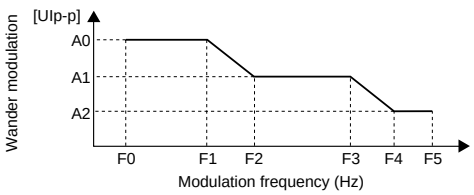
Reference clock input

Auto jitter measurement

Jitter tolerance measurement: Evaluates jitter tolerance point automatically
Jitter sweep measurement: Conforms to high-speed jitter tolerance evaluation for mass production, etc.
Jitter transfer measurement: High dynamic range measurement by selective level method
Frequency sweep measurement: Measures the jitter tolerance automatically while changing the offset

Line wander generation

Modulation frequency: 10 µHz to 0.2 Hz (sine wave)
Amplitude: 0 to 57,600 UIp-p (30 UIp-p steps)



Bit rate (Mbit/s)	Amplitude (UIp-p)			Frequency (Hz)					
	A0	A1	A2	f0	f1	f2	f3	f4	f5
2488.32	57600	6480	810	10µ	180µ	1.6m	16m	0.13	0.2

Accuracy: ±Q% ±160 UIp-p

Frequency error	Frequency range
±8%	10 µHz to 0.1 Hz
±12%	0.1 to 0.2 Hz

Auto wander measurement

Wander sweep measurement

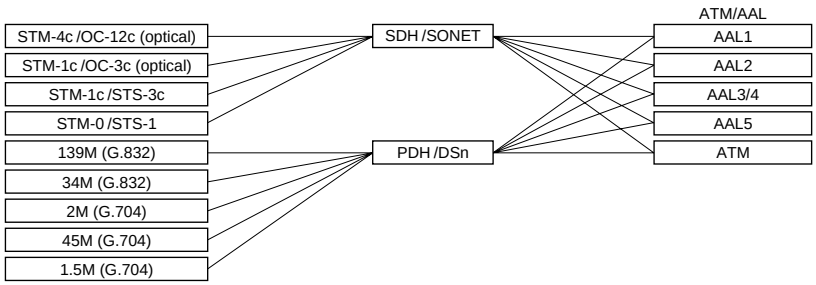
Reference wander generation

Reference wander generation is valid when MU150005A/150006A/150007A Option 03 is mounted.
Off: Able to set non-modulated status
TDEV mask:
The 37 types of TDEV masks that are regulated by ITU-T, ETSI, ANSI, and Bellcore standards are available as default.
It is possible to add the wander modulation to the user specified TDEV mask.
Transient: It is possible to change the A $(1 – e^{-63.7t})$ phase by the timing of the start.
Signal off: It is possible to disconnect the standard signal.

Continued on next page

Wander measurement	Wander measurement is valid when MU150005A/150006A/150007A Option 02 is mounted. Conforms to ITU-T O.172 Reference input: 2.048M (HDB3, clock), 1.544M (AMI/B8ZS, clock), 64k + 8 kHz, 5 MHz, 10 MHz Sampling frequency: 320 Hz, 40 Hz, 1 Hz, 0.1 Hz, 5 mHz (select from MX150001B) Measurement range P-P: 0.0 to 2E10 ns, +P/–P: 0.0 to 1E10 ns, TIE: 0.0 to ±1E10 ns Accuracy: Conform to ITU-T O.172 Measurement time: 10 to 1 x 10^8 s (Max. 120,000 s: MP1570A only) Wander application (requires MX150001B Wander Application Software) TIE: Max. 1 x 10^8 s MTIE: Max. 1 x 10^8 s TDEV: Max. 1 x 10^6 s Frequency offset: Measurement with conform to ANSI TI.105.09 Frequency drift rate: Measurement with conform to ANSI TI.105.09 MRTIE: Evaluation separated from the wander by the frequency variation Wander tolerance (TDEV) measurement: Evaluation by the various TDEV mask generations Wander transfer (TDEV) measurement: Calibration method by simulation, outputting results by the one measurement

• MP0123A ATM Unit

Bit rate	1.544, 2.048, 34.368, 44.736, 139.264, 51.84, 155.52, 622.08 Mbit/s
Mapping	
Traffic pattern	CBR, burst, sawtooth, CBR/PCR with CDV, Poisson
Test patterns	Cell: Single cell PRBS 9, cross cell PRBS 9/15/23, 16-bit word pattern, edit pattern, time stamp O.191: Edit pattern AAL1: Single cell PRBS 9, cross cell PRBS 9/15/23, 16-bit word pattern, edit pattern, time stamp AAL2 (CPS-PDU): Time stamp AAL2 (CPS-PACKET): Single cell PRBS 7, 8-bit word pattern, edit pattern AAL3/4 (SAR-PDU): Time stamp AAL3/4 (CPCS-PDU): Single cell PRBS 9, cross cell PRBS 9/15/23, 16-bit word pattern, edit pattern AAL5: Single cell PRBS 9, cross cell PRBS 9/15/23, 16-bit word pattern, edit pattern
Error addition	Cell: HEC, programmable pattern O.191: Lost cell, misinserted cell, errored cell, SECB AAL1: Lost cell, SNP, PRBS, word AAL2 (CPS-PDU): P, SN, OSF AAL2 (CPS-PACKET): HEC, PRBS, word AAL3/4 (SAR-PDU): SN, CRC10, segment type, LI, abort AAL3/4 (CPCS-PDU): CPI, B/E tag mismatch, BA size, AL, length, PRBS, word AAL5: Frame size, length, CRC32, abort, PRBS, word
Alarm addition	LCD, VP/VC AIS, VP/VC RDI, VP/VC CC, VP/VC loopback cell
PM cell	Error insertion: Lost cell, misinserted cell, BIPV, SECB
Cell editing	O.191, AAL1, AAL2, AAL3/4, AAL5, AIS, RDI, CC, loopback, FM, BR, background (10 ch)
Memorized cell	Possible to send after editing receiver's capture data
Measurement	Mode: Single, repeat, manual Error Cell: Cell count, correctable HEC, uncorrectable HEC, non-conforming cell O.191: Errored cell, lost cell, misinserted cell, SECB AAL1: SAR-PDU count, lost cell, SNP, uncorrectable SNP, PRBS, word AAL2: CPS-PDU count, P, OSF, SN, CPS packet count, CID count, HEC, PRBS, word AAL3/4*: SAR-PDU count, CRC10, MID count (SAR-PDU with selected MID value), SN, ST (segment type), LI, abort, discarded PDU (one of SN error, LI error, abort, COM with ST error, or EOM with ST error), CPCS-PDU count, CPI, B/E tag mismatch, BA size, AL, length, undeliverded PDU (one of CPI error, B/E tag mismatch, BA size error, AL error, or length error), PRBS, word *CRC10 is calculated for all SAR-PDU. The others are calculated for SAR-PDU with specified MID. AAL5: CPCS-PDU count, frame size, length, CRC32, abort, discarded PDU (one of frame size error, length error, CRC32 error, or abort), PRBS, word FM: Lost cell, misinserted cell, BIPV, SECB BR: Lost cell, misinserted cell, BIPV, SECB Alarm: LCD, VP/VC segment AIS, VP/VC end-to-end AIS, VP/VC segment RDI, VP/VC end-to-end RDI, VP/VC segment LOC, VP/VC end-to-end LOC
LED	LCD, VP-AIS, VP-RDI, VP-LOC, VC-AIS, VC-RDI, VC-LOC, errors
Monitor	Live monitor (1023 channel monitor), traffic monitor, cell monitor
Delay measurement	1-point CDV, 2-point CDV
Capture	1 to 2016 cells

• MP0131A Add/Drop Unit

Bit rate	1.544, 2.048, 34.368, 44.736, 139.264 Mbit/s
Level/waveform	1.544 Mbit/s: ANSI T1.102, 0/655 ft 44.736 Mbit/s: ANSI T1.102, 0/450/900 ft (0 ft: Drop only) 2.048/34.368/139 Mbit/s: ITU-T G.703
Connector	BANTAM (100 Ω, balanced): 1.544 Mbit/s (AMI/B8ZS) 3-pin Siemens (120 Ω, balanced): 2.048 Mbit/s (HDB3) BNC (75 Ω, unbalanced): 2.048 Mbit/s, 34.368 Mbit/s (HDB3), 139.264 Mbit/s (CMI)
Mapping	See Fig. 3 and 4

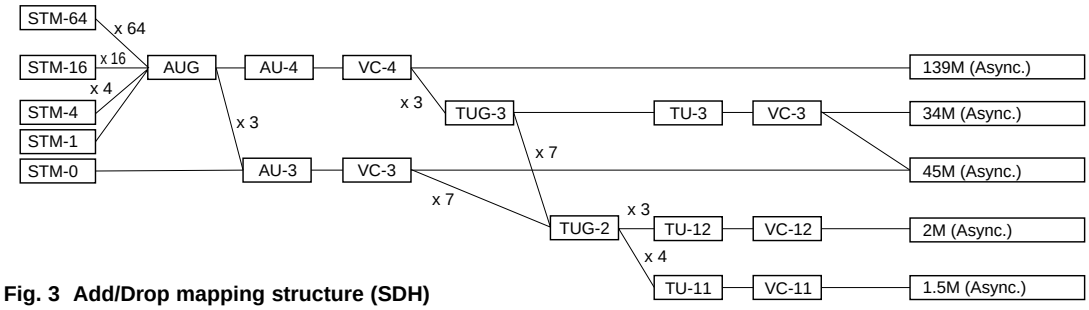


Fig. 3 Add/Drop mapping structure (SDH)

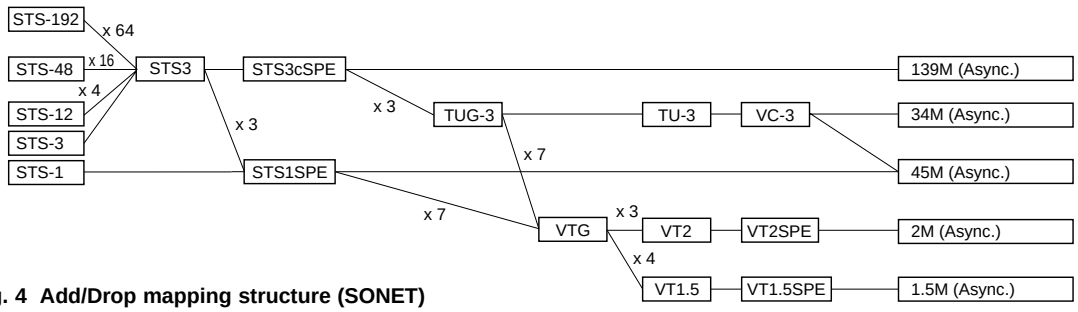


Fig. 4 Add/Drop mapping structure (SONET)

• MP0111A Optical 156M/622M (1.31) Unit

Transmit	Bit rate: 155.52, 622.08 Mbit/s (NRZ) Wavelength: 1310 nm Output level: –11.5 dBm ±3.5 dB Optical safety: IEC 825-1 Class 1, 21CFR1040.10 Class I Connector: FC-PC (SM-F)
Receive	Bit rate: 155.52, 622.08 Mbit/s (NRZ) Sensitivity 156M: –33 to –8 dBm (test pattern: PRBS 2^{23} – 1, BER 10^{-10}, +10˚ to +40˚C) 622M: –28 to –8 dBm (test pattern: PRBS 2^{23} – 1, BER 10^{-10}, +10˚ to +40˚C) Connector: FC-PC (SM-F) Power measurement Measurement range: –30 to 0 dBm (peak power) Accuracy: ≤±1 dB (–20 dBm) Linearity: ≤±1 dB (–30 to 0 dBm)

• MP0112A Optical 156M/622M (1.55) Unit

Transmit	Bit rate: 155.52, 622.08 Mbit/s (NRZ) Wavelength: 1550 nm Output level: –5 dBm ±2 dB Optical safety: IEC825-1 Class 1, 21CFR1040.10 Class I Connector: FC-PC (SM-F)
Receive	Bit rate: 155.52, 622.08 Mbit/s (NRZ) Sensitivity 156M: –33 to –8 dBm (test pattern: PRBS 2^{23} – 1, BER 10^{-10}, +10˚ to +40˚C) 622M: –28 to –8 dBm (test pattern: PRBS 2^{23} – 1, BER 10^{-10}, +10˚ to +40˚C) Connector: FC-PC (SM-F) Power measurement Measurement range: –30 to 0 dBm (peak power) Accuracy: ≤±1 dB (–20 dBm) Linearity: ≤±1 dB (–30 to 0 dBm)

• MP0113A Optical 156M/622M (1.31/1.55) Unit

Transmit	Bit rate: 155.52, 622.08 Mbit/s (NRZ) Wavelength: 1310/1550 nm Output level 1.31 µm: –11.5 dBm ±3.5 dB, 1.55 µm: –5 dBm ±2 dB Optical safety: IEC825-1 Class 1, 21CFR1040.10 Class I Connector: FC-PC (SM-F)
Receive	Bit rate: 155.52, 622.08 Mbit/s (NRZ) Sensitivity 156M: –33 to –8 dBm (test pattern: PRBS 2^{23} – 1, BER 10^{-10}, +10˚ to +40˚C) 622M: –28 to –8 dBm (test pattern: PRBS 2^{23} – 1, BER 10^{-10}, +10˚ to +40˚C) Connector: FC-PC (SM-F) Power measurement Measurement range: –30 to 0 dBm (peak power) Accuracy: ≤±1 dB (–20 dBm) Linearity: ≤±1 dB (–30 to 0 dBm)

• MP0105A CMI Unit

Transmit	Bit rate: 155.52 Mbit/s, Level: 1 ±0.1 V, Connector: BNC (75 Ω)
Receive	Bit rate: 155.52 Mbit/s Level: 1 ±0.1 V (0 to 12 dB, with $\sqrt{f}$ auto correction and monitor function) Connector: BNC (75 Ω)

• MP0108A NRZ Unit

Transmit	Bit rate: 155.52, 622.08 Mbit/s Level: ECL Connector (data, clock): SMA (50 Ω)
Receive	Bit rate: 155.52, 622.08 Mbit/s Level: ECL (–2 V) Connector (data, clock): SMA (50 Ω)

For product ordering information, see pages 4 – 10

• MP0122B 1.5/45/52/52 (1.31) Unit

Optical interface

Transmit	Bit rate: 51.84 Mbit/s (NRZ) Wavelength: 1310 nm Output level: –11.5 dBm ±3.5 dB Optical safety: IEC 825-1 Class 1, 21CFR1040.10 Class I Connector: FC-PC (SM-F)
Receive	Bit rate: 51.84 Mbit/s (NRZ) Sensitivity 52M: –33 to –8 dBm (test pattern: PRBS 2^{23} – 1, BER 10^{-10}, +10˚ to +40˚C) Connector: FC-PC (SM-F) Power measurement Measurement range: –30 to 0 dBm (peak power) Accuracy: ≤±1 dB (–20 dBm) Linearity: ≤±1 dB (–30 to 0 dBm) Monitor input Level: 0.1 to 1.0 Vp-p (AC), Connector: SMA (50 Ω)

• MU150008A/150009A/150010A 2.5G Unit

Bit rate	2488.32 Mbit/s (NRZ)
Optical output	Wavelength: 1310 nm (MU150008A), 1550 nm (MU150009A), 1310/1550 nm (MU150010A) Output level: –4 dBm ±3 dB Optical safety: IEC825-1 Class 3A, 21CFR1040.10 Class IIIb Connector: FC-PC (SM-F)
Optical input	Sensitivity Narrow: –28 to –9 dBm (BER 10^{-10}, +10˚ to +30˚C), –27 to –9 dBm (BER 10^{-10}, 0˚ to +30˚C) Wide: –20 to –9 dBm (BER 10^{-10}, +10˚ to +40˚C) Connector: FC-PC (SM-F) Power measurement Range: –30 to –9 dBm (peak power) Accuracy: ≤±2 dB (–20 dBm) Linearity: ≤±2 dB (–30 to –9 dBm)
Electrical I/O	Transmit (NRZ) Level: ECL (–2 V), Connector (data, clock): SMA (50 Ω) Receive (NRZ) Level: ECL (–2 V), Connector (data, clock): SMA (50 Ω) Monitor input Level: 0.1 to 1.0 Vp-p (AC), Connector (data): SMA (50 Ω)
Auxiliary interface	External clock input, receive clock output, sync. output

• MU150000A 2.5G/10G Unit

Bit rate	9953.28, 2488.32 Mbit/s (NRZ)
Electrical I/O	Transmit (NRZ) Level Data H: 0 to –0.2 V, Data L: –0.85 to –1.4 V Clock H: 0 to –0.2 V, Clock L: –0.85 to –1.3 V Connector (data, clock): SMA (50 Ω) Receive (NRZ) Level Data: 0.65 to 1.4 Vp-p, Clock: 0.65 to 1.3 Vp-p Connector (data, clock): SMA (50 Ω)
Auxiliary interface	External clock input, internal clock output, receive clock output,156M sync. output

• MU150001A/B Optical 10G Tx (1.55) Unit

Bit rate	9953.28, 2488.32 Mbit/s (Option)
Optical output	Wavelength: 10G: 1550 nm band 2.5G: 1310 nm band (Option 01), 1550 nm band (Option 02), 1310/1550 nm band (Option 03) Output level: –4 dBm ±3 dB Optical safety: IEC825-1 Class 3A, 21CFR1040.10 Class IIIb Connector: FC-PC (SMF)
Electrical input	Data input H: 0 to –0.2 V, L: –0.85 to –1.4 V Clock input H: 0 to –0.2 V, L: –0.85 to –1.3 V Connector: SMA 50 Ω

• MU150002A Optical 10G Rx (Narrow) Unit

Bit rate	9953.28, 2488.32 Mbit/s (Option 01)
Optical input	Sensitivity 10G: –13 to –3 dBm (BER 10^{-12}, NRZ, mark ratio: 1/2, PRBS: 2^{31} – 1) 2.5G: –29 to –10 dBm (BER 10^{-11}, NRZ, mark ratio: 1/2, PRBS: 2^{23} – 1) (Option 01) Connector: FC-PC (SMF) Power measurement Range:–16 to 0 dBm (10G, average power), –30 to –10 dBm (2.5G, average power) Accuracy: ≤±2 dB (10G, –10 dBm), ≤±2 dB (2.5G, –20 dBm) Linearity: ≤±2 dB (10G, –16 to 0 dBm), ≤±2 dB (2.5G, –30 to –10 dBm)
Electrical output	Data output: 0.65 to 1.4 Vp-p Clock output: 0.65 to 1.3 Vp-p Connector: SMA 50 Ω

• MU150031A/C Optical 10G Tx (1.55) High Power Unit

Bit rate	MU150031A: 9953.28 Mbit/s MU150031C: 9953.28 Mbit/s, 2488.32 Mbit/s
Optical output	Wavelength: 1525 to 1565 nm Output level: +2 dBm ±2 dB Optical Safety: IEC825-1 (Class 3A), 21CFR1040.10 (Class IIIb) Connector: FC-PC (SM-F)
Electrical input	Data input H: 0 to –0.2 V, L: –0.85 to –1.4 V Clock input H: 0 to –0.2 V, L: –0.85 to –1.3 V Connector: SMA (50 Ω)

• MU150061A/B Optical 10G Tx (1.31) Unit

Bit rate	MU150061A: 9953.28 Mbit/s MU150061B: 9953.28 Mbit/s, 2488.32 Mbit/s
Optical output	Wavelength: 1290 to 1330 nm Output level: +3 dBm ±2 dB Optical Safety: IEC825-1 (Class 3A), 21CFR1040.10 (Class IIIb) Connector: FC-PC (SM-F)
Electrical input	Data input H: 0 to –0.2 V, L: –0.85 to –1.4 V Clock input H: 0 to –0.2 V, L: –0.85 to –1.3 V Connector: SMA (50 Ω)

• MU150017A/B Optical 10G Rx (Wide) Unit

Bit rate	MU150017A: 9953.28 Mbit/s ±100 ppm MU150017B: 9953.28 Mbit/s ±100 ppm, 2488.32 Mbit/s ±100 ppm
Optical output	Wavelength 10G: 1550 nm band, 2.5G: 1310/1550 nm band (MU150017B) Sensitivity: –11 to –3 dBm (10G BER10^{-12}, NRZ, VC4-64c, scramble: on, mark ratio: 1/2, PRBS 2^{23} – 1 –15 to –3 dBm (2.5G BER10^{-12}, NRZ, VC4-16c, scramble: on, mark ratio: 1/2, PRBS 2^{23} – 1 Connector: FC-SPC (SM-F) Power measurement Range: –16 to –2 dBm (10G, average power), –36 to –2 dBm (2.5G average power) Accuracy: ≤±2 dB
Electrical input	Data output: 0.7 to 1.3 Vp-p Clock output: 0.65 to 1.3 Vp-p Connector: SMA (50 Ω) Output phase: Variable output clock phase according to output data (10G only)

Unit	Slot 1	Slot 2	Slot 3	Slot 4/5	Front
MP0121A 2/8/34/139/156M Unit	√				
MP0122A 1.5/45/52M Unit	√*	√			
MP0122B 1.5/45/52/52M (1.31) Unit	√*	√			
MP0123A ATM Unit			√		
MU150005A 2/8/34/139M, 156/622M Jitter Unit				√	
MU150006A 1.5/45/52M, 156/622M Jitter Unit				√	
MU150007A 2/8/34/139M, 1.5/45/52M, 156M/622M Jitter Unit				√	
MP0111A Optical 156/622M (1.31) Unit					√
MP0112A Optical 156/622M (1.55) Unit					√
MP0113A Optical 156/622M (1.31/1.55) Unit					√
MU150008A 2.5G (1.31) Unit		√			
MU150009A 2.5G (1.55) Unit		√			
MU150010A 2.5G (1.31/1.55) Unit		√			
MU150011A 2.5G Jitter Unit			√		
MP0131A Add/Drop Unit	√	√			
MU150000A 2.5G/10G Unit				√	
MU150001A/B Optical 10G Tx (1.55) Unit			√		
MU150002A Optical 10G Rx (Narrow) Unit		√			
MP0105A CMI Unit					√
MP0108A NRZ Unit					√
MU150031A/C Optical 10G Tx (1.55) High Power Unit			√		
MU150061A/B Optical 10G Tx (1.31) Unit			√		
MU150017A/B Optical 10G Rx (Wide) Unit		√			

Note: The same model name units can not be used simultaneously with inserted them in to the plural slots. Only one unit is usable at a time.

*: MP0122A/B can not insert in to slot 1 when MP0123A is inserted in to Slot 3

Ordering information

Please specify model/order number name and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MP1570A*1	SONET/SDH/PDH/ATM Analyzer	
	Standard accessories	
	AC power cord:	1 pc
Z0169	Printer paper (5 rolls/pack):	1 pack
F0079	Fuse, 10 A:	2 pcs
B0329G	Front cover:	1 pc
Z0486	Side cover:	1 pc
J0907Q	Remote interlock cord (for MU150001A/B, MU150008A, MU150009A, MU150010A, MU150031A/C, MU150061A/B):	1 pc
J0908	Remote interlock terminator (for MU150001A/B, MU150008A, MU150009A, MU150010A, MU150031A/C, MU150061A/B):	1 pc
E0008A	Optical output control key (for MU150001A/B, MU150008A, MU150009A, MU150010A, MU150031A/C, MU150061A/B):	2 pcs
J0747A	Fixed optical attenuator (5 dB, for MU150017A/B):	1 pc
J0747B	Fixed optical attenuator (10 dB, for MU150002A):	1 pc
J0900A	Coaxial cable (AA-165-200), 20 cm (for MU150011A):	2 pcs
J0635A	Optical fiber cable (FC · PC-FC · PC), 1 m (for MU150002A, MU150008A, MU150009A, MU150010A, MU150017A/B):	1 pc
MX150001B	Wander (MTIE, TDEV) Measurement Application Software (supplied with MU150005A-02, MU150006A-02, MU150007A-02):	1 pc
W1719AE	MP1570A operation manual (Vol. 1 Basic operation for SDH):	1 copy
W1720AE	MP1570A operation manual (Vol. 1 Basic operation for SONET):	1 copy
W1721AE	MP1570A operation manual (Vol. 2 Remote control):	1 copy
W1722AE	MP1570A operation manual (Vol. 3 ATM measurement):	1 copy
W1723AE	MP1570A operation manual (Vol. 4 2.5G/10G measurement):	1 copy
W1724AE	MP1570A operation manual (Vol. 5 Add/Drop function):	1 copy
W1725AE	MP1570A operation manual (Vol. 6 Jitter/wander measurement, for MU150005A/150006A/150007A):	1 copy
W1726AE	MP1570A operation manual (Vol. 7 2.5G jitter/wander measurement, for MU150011A):	1 copy
W1763AE	Wander (MTIE, TDEV) APPLI SOFT manual (supplied with MX150001B):	1 copy
J1002A	Semi-rigid cable (for MU150001A/B, MU150031A/C, MU150061A/B):	2 pcs
J1002B	Semi-rigid cable (for MU150002A, MU150017A/B):	2 pcs
J1002C	Semi-rigid cable (for MU150000A):	3 pcs
	Plug-in units	
MP0121A	2/8/34/139/156M Unit	
MP0122A	1.5/45/52M Unit	
MP0122B*2	1.5/45/52/52M (1.31) Unit	
MP0123A	ATM Unit	
MU150008A*2	2.5G (1.31) Unit (with optical power meter)	
MU150009A*2	2.5G (1.55) Unit (with optical power meter)	
MU150010A*2	2.5G (1.31/1.55) Unit (with optical power meter)	
MP0131A	Add/Drop Unit	
MU150000A	2.5G/10G Unit	
MU150001A*2	Optical 10G Tx (1.55) Unit (2 km transmission)	
MU150001B*2	Optical 10G Tx (1.55) Unit (40 km transmission)	
MU150002A*2	Optical 10G Rx (Narrow) Unit (with optical power meter)	
MP0111A*2	Optical 156M/622M (1.31) Unit (with optical power meter)	
MP0112A*2	Optical 156M/622M (1.55) Unit (with optical power meter)	
MP0113A*2	Optical 156M/622M (1.31/1.55) Unit (with optical power meter, 1.31/1.55 switchable)	
MU150017A	Optical 10G Rx (Wide) Unit	
MU150017B	Optical 2.5G/10G Rx (Wide) Unit	
MU150031A	Optical 10G Tx (1.55) High Power Unit	
MU150031C	Optical 2.5G/10G Tx (1.55) High Power Unit	
MU150061A	Optical 10G Tx (1.31) Unit	

Continued on next page

For product ordering information, see pages 4 – 10

Model/Order No.	Name
MU150061B	Optical 2.5G/10G Tx (1.31) Unit
MU150005A	2/8/34/139M, 156/622M Jitter Unit [jitter generation/ measurement only (requires MP0121A)]
MU150006A	1.5/45/52M, 156/622M Jitter Unit [jitter generation/ measurement only (requires MP0122A/B)]
MU150007A	2/8/34/139M, 1.5/45/52M, 156/622M Jitter Unit [jitter generation/measurement only (requires MP0121A or MP0122A/B)]
MU150011A	2.5G Jitter Unit [jitter generation/measurement only (requires MU150008A/150009A or MU150010A)]
MP0105A	CMI Unit
MP0108A	NRZ Unit
	Options
MP1570A-01*3	RS-232C
MP1570A-02*3	GPIB
MP1570A-03*3	Ethernet
MP1570A-04*3	VGA output
MP1570A-06	MUX/DEMUX (2/8/34/139 Mbit/s, for MP0121A)
MP1570A-07	MUX/DEMUX (1.5/45 Mbit/s, for MP0122A/B)
MP1570A-08	45M-2M MUX/DEMUX (requires MP0121A and MP0122A/B)
MP1570A-09	Japan mapping (requires MP0122A or MP0122B)
MP1570A-10*1	SDH
MP1570A-11*1	SONET
MP1570A-13	Frame memory capture (156M/622M, 64 frame)
MP1570A-14	IP-over-SONET/SDH (requires MP1570A-13)
MP1570A-15	IP-over-ATM (requires MP0123A)
MP1570A-22	K1/K2 overwrite through
MU150005A-02	Wander measurement
MU150006A-02	Wander measurement
MU150007A-02	Wander measurement
MU150005A-03	Wander reference output
MU150006A-03	Wander reference output
MU150007A-03	Wander reference output
MU150008A-01	Frame memory capture (2.5G, 64 frame)
MU150009A-01	Frame memory capture (2.5G, 64 frame)
MU150010A-01	Frame memory capture (2.5G, 64 frame)
MU150000A-01	Frame memory capture (2.5G/10G, 26 frame)
MU150001A/B-01	2.5G (1.31)
MU150001A/B-02	2.5G (1.55)
MU150001A/B-03	2.5G (1.31/1.55)
MU150002A-01	2.5G
MU150002A-04	Available for 10G (1.31)
MP0111A/0112A-37	FC connector (replaceable, 2 sets)
MP0111A/0112A-38	ST connector (replaceable, 2 sets
MP0111A/0112A-39	DIN connector (replaceable, 2 sets)
MP0111A/0112A-40	SC connector (replaceable, 2 sets)
MP0111A/0112A-43	HMS-10/A connector (replaceable, 2 sets)
MP0113A-37	FC connector (replaceable, 3 sets)
MP0113A-38	ST connector (replaceable, 3 sets)
MP0113A-39	DIN connector (replaceable, 3 sets)
MP0113A-40	SC connector (replaceable, 3 sets)
MP0113A-43	HMS-10/A connector (replaceable, 3 sets)
MP0122B-37	FC connector (replaceable, 2 sets)
MP0122B-38	ST connector (replaceable, 2 sets)
MP0122B-39	DIN connector (replaceable, 2 sets)
MP0122B-40	SC connector (replaceable, 2 sets)
MP0122B-43	HMS-10/A connector (replaceable, 2 sets)
MU150008A-37	FC connector (replaceable, 2 sets)
MU150008A-38	ST connector (replaceable, 2 sets)
MU150008A-39	DIN connector (replaceable, 2 sets)
MU150008A-40	SC connector (replaceable, 2 sets)

Model/Order No.	Name
MU150008A-43	HMS-10/A connector (replaceable, 2 sets)
MU150009A-37	FC connector (replaceable, 2 sets)
MU150009A-38	ST connector (replaceable, 2 sets)
MU150009A-39	DIN connector (replaceable, 2 sets)
MU150009A-40	SC connector (replaceable, 2 sets)
MU150009A-43	HMS-10/A connector (replaceable, 3 sets)
MU150010A-37	FC connector (replaceable, 3 sets)
MU150010A-38	ST connector (replaceable, 3 sets)
MU150010A-39	DIN connector (replaceable, 3 sets)
MU150010A-40	SC connector (replaceable, 3 sets)
MU150010A-43	HMS-10/A connector (replaceable, 3 sets)
MU150001A/B-37	FC connector (replaceable, 1 set)
MU150001A/B-38	ST connector (replaceable, 1 set)
MU150001A/B-39	DIN connector (replaceable, 1 set)
MU150001A/B-40	SC connector (replaceable, 1 set)
MU150001A/B-43	HMS-10/A connector (replaceable, 1 set)
MU150002A-37	FC connector (replaceable, 1 set)*4
MU150002A-38	ST connector (replaceable, 1 set)*4
MU150002A-39	DIN connector (replaceable, 1 set)*4
MU150002A-40	SC connector (replaceable, 1 set)*4
MU150002A-43	HMS-10/A connector (replaceable, 1 set)*4
MU150017A/B-37	FC connector (user replaceable, 1 set)
MU150017A/B-38	ST connector (user replaceable, 1 set)
MU150017A/B-39	DIN connector (user replaceable, 1 set)
MU150017A/B-40	SC connector (user replaceable, 1 set)
MU150017A/B-43	HMS-10/A connector (user replaceable, 1 set)
MU150031A/C-37	FC connector (user replaceable, 1 set)
MU150031A/C-38	ST connector (user replaceable, 1 set)
MU150031A/C-39	DIN connector (user replaceable, 1 set)
MU150031A/C-40	SC connector (user replaceable, 1 set)
MU150031A/C-43	HMS-10/A connector (user replaceable, 1 set)
MU150061A/B-37	FC connector (user replaceable, 1 set)
MU150061A/B-38	ST connector (user replaceable, 1 set)
MU150061A/B-39	DIN connector (user replaceable, 1 set)
MU150061A/B-40	SC connector (user replaceable, 1 set)
MU150061A/B-43	HMS-10/A connector (user replaceable, 1 set)
	Maintenance service*5
MP1570A-90	Extension service 3 years
MP0121A-90	Extension service 3 years
MP0122A-90	Extension service 3 years
MP0122B-90	Extension service 3 years
MP0123A-90	Extension service 3 years
MU150005A-90	Extension service 3 years
MU150006A-90	Extension service 3 years
MU150007A-90	Extension service 3 years
MU150008A-90	Extension service 3 years
MU150009A-90	Extension service 3 years
MU150010A-90	Extension service 3 years
MU150011A-90	Extension service 3 years
MU150000A-90	Extension service 3 years
MU150001A-90	Extension service 3 years
MU150001B-90	Extension service 3 years
MU150002A-90	Extension service 3 years
MP0111A-90	Extension service 3 years
MP0112A-90	Extension service 3 years
MP0113A-90	Extension service 3 years
MP0105A-90	Extension service 3 years
MP0108A-90	Extension service 3 years
MU150017A/B-90	Extension service 3 years
MU150031A/C-90	Extension service 3 years
MU150061A/B-90	Extension service 3 years

Continued on next page

Model/Order No.	Name
	Application equipment
MP1777A	10 GHz Jitter Analyzer
MP9677B	E/O, O/E Converter
MU967701A	Clock Recovery Unit (9.95328 Gbit/s)
MP1580A	Portable 2.5G/10G Analyzer
MU150018A	2.5G/10G Jitter Unit (for MP1580A)
	Optional accessories
MN9320A	Optical Channel Drop Unit (OCD)
MX150001B	Wander (MTIE, TDEV) Measurement Application Software (supplied with MU150005A-02/150006A-02/150007A-02)
J0796A	ST connector (replaceable, with protective caps, 1 set)
J0796B	DIN connector (replaceable, with protective caps, 1 set)
J0796C	SC connector (replaceable, with protective caps, 1 set)
J0796D	HMS-10/A connector (replaceable, with protective caps, 1 set)
J0796E	FC connector (replaceable, with protective caps, 1 set)
J0162A	Balanced cable, 1 m (Siemens 3p-Siemens 3p)
J0162B	Balanced cable, 2 m (Siemens 3p-Siemens 3p)
J0845A	Balanced cable, 6 ft (BANTAM 3P/BANTAM 3P)
J0775D	Coaxial cable (BNC-P620 · 3C-2WS · BNC-P620, 75 Ω), 2 m
J0776D	Coaxial cable (BNC-P-3W · 3D-2W · BNC-P-3W, 50 Ω), 2 m
J0898A	Conversion cable (M-1PS · BANTAM 3P), 1 m
J0898B	Conversion cable (M-1PS · BANTAM 3P), 2 m
J0635A	Optical fiber cable, 1 m (SM, FC-SPC connector both ends)
J0635B	Optical fiber cable, 2 m (SM, FC-SPC connector both ends)
J0635C	Optical fiber cable, 3 m (SM, FC-SPC connector both ends)
J0660A	Optical fiber cable, 1 m (SM, SC connector, both-ends)
J0660B	Optical fiber cable, 2 m (SM, SC connector, both-ends)
J0660C	Optical fiber cable, 3 m (SM, SC connector, both-ends)
J0756A	Optical fiber cable, 1 m (SM, ST connector, both-ends)
J0756B	Optical fiber cable, 2 m (SM, ST connector, both-ends)
J0756C	Optical fiber cable, 3 m (SM, ST connector, both-ends)
J0747A	Fixed optical attenuator (5 dB)
J0747B	Fixed optical attenuator (10 dB)
J0747C	Fixed optical attenuator (15 dB)
J0747D	Fixed optical attenuator (20 dB)
J1049A	Fixed optical attenuator, SC (5 dB)
J1049B	Fixed optical attenuator, SC (10 dB)
J1049C	Fixed optical attenuator, SC (15 dB)
J1049D	Fixed optical attenuator, SC (20 dB)
J1050A	Fixed optical attenuator, ST (5 dB)
J1050B	Fixed optical attenuator, ST (10 dB)
J1050C	Fixed optical attenuator, ST (15 dB)
J1050D	Fixed optical attenuator, ST (20 dB)
J0322B	Coaxial cable (11SMA · SUCOFLEX104 · 11SMA), 1 m
J0008	GPIB cable, 2 m
A0006	Head set
B0453B	Blank panel (for front slot)
B0454C	Blank panel (for slot 1 to 3)
B0454D	Blank panel (for slot 4/5)
B0448	Soft case
B0336C	Carrying case

∗1: Must specify SDH (Option 10) or SONET (Option 11) when ordering depends on your system. The option price is included in the MP1570A. These two options can be installed simultaneously. But in this case, one option price is charged.

∗2: Specify the connector to be supplied as the standard connector when ordering the above options. If the connector is not specified the FC connector (MP0111A/0112A/0113A/0122B-37, MU150008A/150009A/150010A/150001A/150001B/150002A-37) is supplied as standard.

∗3: The video output, RS-232C, GPIB and Ethernet options cannot all be used simultaneously. Only the video output + RS-232C, or video output + GPIB, or RS-232C + GPIB board, or Ethernet board combinations support simultaneous use, so change the board combinations according to the purpose.

∗4: With Option 01, 2 sets

∗5: Please ask your local Anritsu Field Office or Sales. Representative for price and availability.

The units for MP1552A/B and MP1555A/B can be used with MP1570A.

For product ordering information, see pages 4 – 10

SONET/SDH/PDH/ATM ANALYZER

MP1570A1

1.5 Mbit/s to 10 Gbit/s

Supports North American and European Mapping by One Box

NEW

CE

GPIB OPTION

MP1570A1 is a SONET/SDH/PDH/ATM Analyzer which has one more slot compared with MP1570A. It can measure bit rate of 2488M (OC-48) or more in North American and European mapping without the DSn and PDH plug-in units exchange.

Specifications

• General

(Other specifications are same as MP1570A. For the specification, refer to page 152.)

Printer	Internal, external
Internal memory	Measurement settings memory: 10 Graphics memory: 15
Others	FDD, RS-232C (Option 01)*1, GPIB (Option 02)*1, Ethernet (Option 03)*1, Video output (Option 04)*1, buzzer, clock, help, screen copy
EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)
Dimensions and mass	320 (W) x 222 (H) x 350 (D) mm, 12 kg approx. (excluding plug-in units and options)
Power	100 to 240 Vac, 47.5 to 63 Hz, ≤500 VA
Temperature	0° to +40°C

*1: The video output, RS-232C, GPIB and Ethernet options cannot all be used simultaneously. Only the video output + RS-232C, or video output + GPIB, or RS-232C + GPIB board, or Ethernet board combinations support simultaneous use, so change the board combinations according to the purpose.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MP1570A1*1	SONET/SDH/PDH/ATM Analyzer	
	Standard accessories	
	AC power cord:	1 pc
Z0169	Printer paper (5 rolls/pack):	1 pack
F0079	Fuse, 10 A:	2 pcs
B0482	Front cover:	1 pc
J0907Q	Remote interlock cord (for MU150001A/B, MU150008A, MU150009A, MU150010A, MU150031A/C, MU150061A/B):	1 pc
J0908	Remote interlock terminator (for MU150001A/B, MU150008A, MU150009A, MU150010A, MU150031A/C, MU150061A/B):	1 pc
E0008A	Optical output control key (for MU150001A/B, MU150008A, MU150009A, MU150010A, MU150031A/C, MU150061A/B):	2 pc
J0747A	Fixed optical attenuator (5 dB, for MU150017A/B):	1 pc
J0747B	Fixed optical attenuator (10 dB, for MU150002A):	1 pc
J0900A	Coaxial cable (AA-165-200, 20 cm, for MU150011A):	2 pcs
J0635A	Optical fiber cable (FC · PC-FC · PC, 1 m, for MU150002A/150008A/150009A/150010A, MU150017A/B):	1 pc
MX150001B	Wander (MTIE, TDEV) Measurement Application Software (supplied with MU150005A-02/150006A-02/150007A-02):	1 pc
W1882AE	MP1570A1 operation manual:	1 copy
W1719AE	MP1570A operation manual (Vol. 1 Basic operation for SDH):	1 copy
W1720AE	MP1570A operation manual (Vol. 1 Basic operation for SONET):	1 copy
W1721AE	MP1570A operation manual (Vol. 2 Remote control):	1 copy
W1722AE	MP1570A operation manual (Vol. 3 ATM measurement):	1 copy
W1723AE	MP1570A operation manual (Vol. 4 2.5G/10G measurement):	1 copy

Continued on next page

Model/Order No.	Name
W1724AE	MP1570A operation manual (Vol. 5 Add/Drop function): 1 copy
W1725AE	MP1570A operation manual (Vol. 6 Jitter/wander measurement, for MU150005A/150006A/150007A): 1 copy
W1726AE	MP1570A operation manual (Vol. 7 2.5G jitter/wander measurement, for MU150011A): 1 copy
W1763AE	Wander (MTIE, TDEV) Measurement Application Software (supplied with MX150001B): 1 copy
J1002A	Semi-rigid cable (for MU150001A/B, MU150031A/C, MU150061A/B): 2 pcs
J1002B	Semi-rigid cable (for MU150002A, MU150017A/B): 2 pcs
J1002C	Semi-rigid cable (for MU150000A): 3 pcs
	Plug-in units
MP0121A	2/8/34/139/156M Unit
MP0122A	1.5/45/52M Unit
MP0122B*2	1.5/45/52/52M (1.31) Unit
MP0123A	ATM Unit
MU150005A	2/8/34/139M, 156/622M Jitter Unit (only jitter generation/measurement, requires MP0121A)
MU150006A	1.5/45/52M, 156/622M Jitter Unit (only jitter generation/measurement, requires MP0122A/B)
MU150007A	2/8/34/139M, 1.5/45/52M, 156/622M Jitter Unit (only jitter generation/measurement, requires MP0121A or MP0122A/B)
MU150008A*2	2.5G (1.31) Unit (with optical power meter)
MU150009A*2	2.5G (1.55) Unit (with optical power meter)
MU150010A*2	2.5G (1.31/1.55) Unit (with optical power meter)
MU150011A	2.5G Jitter Unit (only jitter generation/measurement, requires MU150008A, MU150009A, or MU150010A)
MP0131A	Add/Drop Unit
MU150000A	2.5G/10G Unit
MU150001A*2	Optical 10G Tx (1.55) Unit (2 km transmission)
MU150001B*2	Optical 10G Tx (1.55) Unit (40 km transmission)
MU150002A*2	Optical 10G Rx (Narrow) Unit (with optical power meter)
MP0111A*2	Optical 156M/622M (1.31) Unit (with optical power meter)
MP0112A*2	Optical 156M/622M (1.55) Unit (with optical power meter)
MP0113A*2	Optical 156M/622M (1.33/1.55) Unit (with optical power meter, 1.31/1.55 switchable)
MU150017A	Optical 10G Rx (Wide) Unit
MU150017B	Optical 2.5G/10G Rx (Wide) Unit
MU150031A	Optical 10G Tx (1.55) High Power Unit
MU150031C	Optical 2.5G/10G Tx (1.55) High Power Unit
MU150061A	Optical 10G Tx (1.31) Unit
MU150061B	Optical 2.5G/10G Tx (1.31) Unit
MP0105A	CMI Unit
MP0108A	NRZ Unit
	Options
MP1570A1-01*3	RS-232C
MP1570A1-02*3	GPIB
MP1570A1-03*3	Ethernet
MP1570A1-04*3	VGA output
MP1570A1-06	MUX/DEMUX (2/8/34/139 Mbit/s, for MP0121A)
MP1570A1-07	MUX/DEMUX (1.5/45 Mbit/s, for MP0122A/B)
MP1570A1-08	45M-2M MUX/DEMUX (requires MP0121A and MP0122A/B)
MP1570A1-09	Japan mapping (requires MP0122A or MP0122B)
MP1570A1-10*1	SDH
MP1570A1-11*1	SONET
MP1570A1-13	Frame memory capture (156M/622M, 64 frame)
MP1570A1-14	IP-over-SONET/SDH (requires option of frame memory/capture)
MP1570A1-15	IP-over-ATM (requires MP0123A)
MP1570A1-22	K1/K2 overwrite through
MU150005A-02	Wander measurement
MU150006A-02	Wander measurement
MU150007A-02	Wander measurement
MU150005A-03	Wander reference output
MU150006A-03	Wander reference output
MU150007A-03	Wander reference output
MU150008A-01	Frame memory capture (2.5G, 64 frame)
MU150009A-01	Frame memory capture (2.5G, 64 frame)
MU150010A-01	Frame memory capture (2.5G, 64 frame)
MU150000A-01	Frame memory capture (2.5G/10G, 26 frame)
MU150001A/B-01	2.5G (1.31)
MU150001A/B-02	2.5G (1.55)
MU150001A/B-03	2.5G (1.31/1.55)
MU150002A-01	2.5G
MU150002A-04	Available for 10G (1.31)
MP0111A/0112A-37	FC connector (replaceable, 2 sets)
MP0111A/0112A-38	ST connector (replaceable, 2 sets)
MP0111A/0112A-39	DIN connector (replaceable, 2 sets)

Model/Order No.	Name
MP0111A/0112A-40	SC connector (replaceable, 2 sets)
MP0111A/0112A-43	HMS-10/A connector (replaceable, 2 sets)
MP0113A-37	FC connector (replaceable, 3 sets)
MP0113A-38	ST connector (replaceable, 3 sets)
MP0113A-39	DIN connector (replaceable, 3 sets)
MP0113A-40	SC connector (replaceable, 3 sets)
MP0113A-43	HMS-10/A connector (replaceable, 3 sets)
MP0122B-37	FC connector (replaceable, 2 sets)
MP0122B-38	ST connector (replaceable, 2 sets)
MP0122B-39	DIN connector (replaceable, 2 sets)
MP0122B-40	SC connector (replaceable, 2 sets)
MP0122B-43	HMS-10/A connector (replaceable, 2 sets)
MU150008A-37	FC connector (replaceable, 2 sets)
MU150008A-38	ST connector (replaceable, 2 sets)
MU150008A-39	DIN connector (replaceable, 2 sets)
MU150008A-40	SC connector (replaceable, 2 sets)
MU150008A-43	HMS-10/A connector (replaceable, 2 sets)
MU150009A-37	FC connector (replaceable, 2 sets)
MU150009A-38	ST connector (replaceable, 2 sets)
MU150009A-39	DIN connector (replaceable, 2 sets)
MU150009A-40	SC connector (replaceable, 2 sets)
MU150009A-43	HMS-10/A connector (replaceable, 2 sets)
MU150010A-37	FC connector (replaceable, 3 sets)
MU150010A-38	ST connector (replaceable, 3 sets)
MU150010A-39	DIN connector (replaceable, 3 sets)
MU150010A-40	SC connector (replaceable, 3 sets)
MU150010A-43	HMS-10/A connector (replaceable, 3 sets)
MU150001A/B-37	FC connector (replaceable, 1 set)
MU150001A/B-38	ST connector (replaceable, 1 set)
MU150001A/B-39	DIN connector (replaceable, 1 set)
MU150001A/B-40	SC connector (replaceable, 1 set)
MU150001A/B-43	HMS-10/A connector (replaceable, 1 set)
MU150002A-37	FC connector (replaceable, 1 set*4)
MU150002A-38	ST connector (replaceable, 1 set*4)
MU150002A-39	DIN connector (replaceable, 1 set*4)
MU150002A-40	SC connector (replaceable, 1 set*4)
MU150002A-43	HMS-10/A connector (replaceable, 1 set*4)
MU150017A/B-37	FC connector (user replaceable, 1 set)
MU150017A/B-38	ST connector (user replaceable, 1 set)
MU150017A/B-39	DIN connector (user replaceable, 1 set)
MU150017A/B-40	SC connector (user replaceable, 1 set)
MU150017A/B-43	HMS-10/A connector (user replaceable, 1 set)
MU150031A/C-37	FC connector (user replaceable, 1 set)
MU150031A/C-38	ST connector (user replaceable, 1 set)
MU150031A/C-39	DIN connector (user replaceable, 1 set)
MU150031A/C-40	SC connector (user replaceable, 1 set)
MU150031A/C-43	HMS-10/A connector (user replaceable, 1 set)
MU150061A/B-37	FC connector (user replaceable, 1 set)
MU150061A/B-38	ST connector (user replaceable, 1 set)
MU150061A/B-39	DIN connector (user replaceable, 1 set)
MU150061A/B-40	SC connector (user replaceable, 1 set)
MU150061A/B-43	HMS-10/A connector (user replaceable, 1 set)
	Maintenance service*5
MP0121A-90	Extension service 3 years
MP0122A-90	Extension service 3 years
MP0122B-90	Extension service 3 years
MP0123A-90	Extension service 3 years
MU150005A-90	Extension service 3 years
MU150006A-90	Extension service 3 years
MU150007A-90	Extension service 3 years
MU150008A-90	Extension service 3 years
MU150009A-90	Extension service 3 years
MU150010A-90	Extension service 3 years
MU150011A-90	Extension service 3 years
MU150000A-90	Extension service 3 years
MU150001A-90	Extension service 3 years
MU150001B-90	Extension service 3 years
MU150002A-90	Extension service 3 years
MP0111A-90	Extension service 3 years
MP0112A-90	Extension service 3 years
MP0113A-90	Extension service 3 years
MP0105A-90	Extension service 3 years
MP0108A-90	Extension service 3 years
MU150017A/B-90	Extension service 3 years
MU150031A/C-90	Extension service 3 years
MU150061A/B-90	Extension service 3 years
	Application equipment
MP1777A	10 GHz Jitter Analyzer
MP9677B	E/O, O/E Converter
MU967701A	Clock Recovery Unit (9.95328 Gbit/s)
MP1580A	Portable 2.5G/10G Analyzer
MU150018A	2.5G/10G Jitter Unit (for MP1580A)

Continued on next page

Model/Order No.	Name
	Optional accessories
J0796A	ST connector (replaceable, with protective caps, 1 set)
J0796B	DIN connector (replaceable, with protective caps, 1 set)
J0796C	SC connector (replaceable, with protective caps, 1 set)
J0796D	HMS-10/A connector (replaceable, with protective caps, 1 set)
J0796E	FC connector (replaceable, with protective caps, 1 set)
J0162A	Balanced cable (Siemens 3P-Siemens 3P), 1 m
J0162B	Balanced cable (Siemens 3P-Siemens 3P), 2 m
J0845A	Balanced cable (BANTAM 3P/BANTAM 3P), 6 ft
J0775D	Coaxial cable (BNC-P620 · 3C-2WS · BNC-P620, 75 Ω), 2 m
J0776D	Coaxial cable (BNC-P-3W · 3D-2W · BNC-P-3W, 50 Ω), 2 m
J0898A	Conversion cable (M-1PS · BANTAM 3P), 1 m
J0898B	Conversion cable (M-1PS · BANTAM 3P), 2 m
J0635A	Optical fiber cable (SM, FC-SPC connector both ends), 1 m
J0635B	Optical fiber cable (SM, FC-SPC connector both ends), 2 m
J0635C	Optical fiber cable (SM, FC-SPC connector both ends), 3 m
J0660A	Optical fiber cable, 1 m (SM, SC connector, both-ends)
J0660B	Optical fiber cable, 2 m (SM, SC connector, both-ends)
J0660C	Optical fiber cable, 3 m (SM, SC connector, both-ends)
J0756A	Optical fiber cable, 1 m (SM, ST connector, both-ends)
J0756B	Optical fiber cable, 2 m (SM, ST connector, both-ends)
J0756C	Optical fiber cable, 3 m (SM, ST connector, both-ends)
J0747A	Fixed optical attenuator (5 dB)
J0747B	Fixed optical attenuator (10 dB)
J0747C	Fixed optical attenuator (15 dB)
J0747D	Fixed optical attenuator (20 dB)
J1049A	Fixed optical attenuator, SC (5 dB)
J1049B	Fixed optical attenuator, SC (10 dB)
J1049C	Fixed optical attenuator, SC (15 dB)
J1049D	Fixed optical attenuator, SC (20 dB)
J1050A	Fixed optical attenuator, ST (5 dB)
J1050B	Fixed optical attenuator, ST (10 dB)
J1050C	Fixed optical attenuator, ST (15 dB)
J1050D	Fixed optical attenuator, ST (20 dB)
J0322B	Coaxial cable (11SMA · SUCOFLEX104 · 11SMA), 1 m
J0008	GPIB cable, 2 m
A0006	Head set
B0453B	Blank panel (for front panel)
B0454C	Blank panel (for Slot 1 to 3)
B0454D	Blank panel (for Slot 4/5)

∗1: Must specify SDH (Option 10) or SONET (Option 11) when ordering depends on your system. The option price is included in the MP1570A1. These two options can be installed simultaneously. But in this case, one option price is charged.

∗2: Specify the connector to be supplied as the standard connector when ordering the above options. If the connector is not specified the FC connector MP0111A/0112A/0113A/0122B-37, MU150008A/150009A/150010A/150001A/150001B/150002A-37) is supplied as standard.

∗3: The video output, RS-232C, GPIB and Ethernet options cannot all be used simultaneously. Only the video output + RS-232C, or video output + GPIB, or RS-232C + GPIB board, or Ethernet board combinations support simultaneous use, so change the board combinations according to the purpose.

∗4: With Option 01, 2 sets

∗5: Please ask your local Anritsu Field Office or Sales. Representative for price and availability.

PORTABLE 2.5G/10G ANALYZER
MP1580A

For 2.5G/10G Jitter/Wander Measurements

NEW

CE

The MP1580A is a unique and powerful solution for analyzing jitter at the standard OC-48/192 or STM-16/64 bit rates. It can measure jitter of 2.5G/10G electrical interfaces (clock signal) with a simple operation. In addition, when used in combination with the MP1570A SONET/SDH/PDH/ATM Analyzer, evaluation of jitter characteristics in digital transmission lines, systems and devices, such as — jitter tolerance, jitter transfer, jitter generation, etc., can be performed easily.

Functions

- **Complies with the latest ITU-T O.172 and Bellcore GR-1377 standards**

The MP1580A conforms to both the OC-192/STM-64 jitter measurement standards and supports required jitter modulation amplitude of 4000 UIp-p and 80 MHz jitter bandwidth.

- **Supports 10 GHz wander measurement according to the latest ITU-T G.813 standard (option)**

The MP1580A can generate and measure various types of wander. It can generate wander in the frequency range of 10 µHz to 10 Hz at 400,000 UIp-p max. In addition, MTIE/TDEV can be measured in real-time using an external PC and optional application software (MX150002A).

- **Single cabinet support for both 2.5G and 10G jitter/wander measurements**

Just one MP1580A is required for 2.5G and 10G jitter generation and analysis. When combined with the MP1570A and MU150000A, jitter can be added to SONET/SDH signals and measured.

- **Differences from existing instrument (MP1777A)**

Anritsu launched the MP1777A 10 GHz Jitter Analyzer in February of 1998, as a jitter measurement solution for OC-192/STM-64 (9953M). The new MP1580A Portable 2.5G/10G Jitter Analyzer is providing more convenience in measurement without the need for ancillary equipment (network analyzer, external E/O-O/E converter). Anritsu has also developed a Wide Band O/E Converter (MU150017A/B) for the MP1570A to support jitter measurement of 80 MHz at 9953.28 Mbit/s as required by ITU-T standard in conjunction with the MP1580A. Although it uses two cabinets, the compact size makes the system ideal for R&D, manufacturing, installation and maintenance. In addition, the MP1570A can be controlled from the MP1580A for performing automatic measurements, such as Jitter Tolerance and Jitter Transfer.

Application

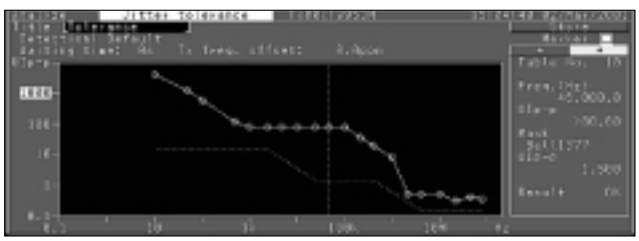
- **Output jitter measurement**

The MP1580A can easily measure the jitter clock signal (electrical interface only) by just inputting the output clock of DUT directly.

Optical signals can be measured easily by combining the MP1580A with the MP1570A, MU150000A, MU150001A and MU150017A/B.

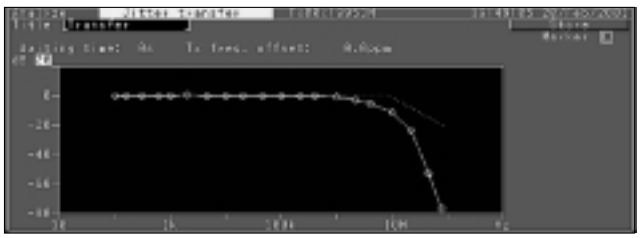
- **Jitter tolerance measurement**

When the MP1580A is used with the MP1570A (send/receive jittered clock), jitter tolerance tests can be performed on OC-192/STM-64 and OC-48/STM-16 signals of electrical and optical interfaces.

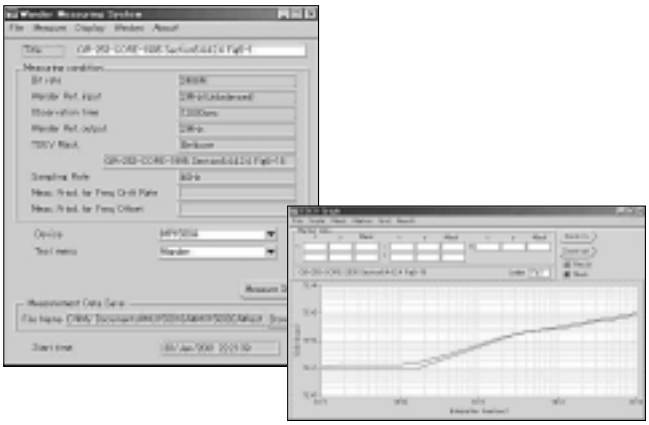


For product ordering information, see pages 4 – 10

• Jitter transfer measurement
When the MP1580A is used with the MP1570A (send/receive jittered clock), jitter transfer tests can be performed on OC-192/STM-64 and OC-48/STM-16 signals of electrical and optical interfaces.



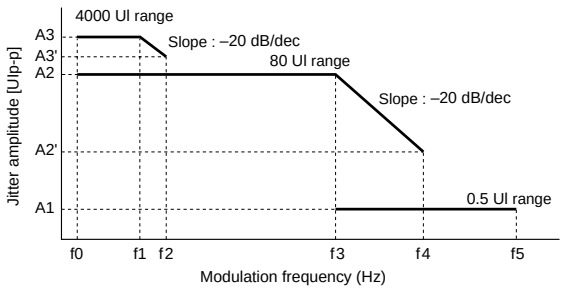
• Wander generation and measurement
The MP1580A can generate and measure of wander conforming to ITU-T O.172 and also generation of TDEV conforming to ITU-T G.813. It also can measure TIE (Time Interval Error) by itself and measure MTIE and TDEV by connection of an external PC in which MX150002A is installed.



Specifications

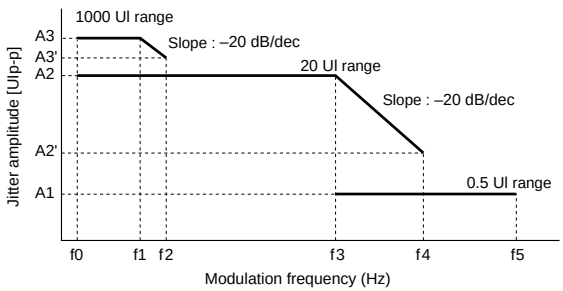
Jitter generation

Frequency
Range: 9953.28, 2488.32 MHz
Offset range: ±100 ppm
Resolution: 0.1 ppm
Accuracy: ±0.1 ppm (calibrate after 60 min warm-up, 23 ±5˚C)
Generation function: Clock signal output, data signal output (with MP1570A), jitter on, wander on/off
Modulation source: Internal (sine wave), external (for jitter generation function only)
Modulation frequency accuracy: fm ±100 ppm (0.1 Hz to 80 MHz)
Jitter generation: Conform to ITU-T O.172



Bit rate (bit/s)	f0 (Hz)	f1 (Hz)	f2 (Hz)	f3 (kHz)	f4 (MHz)	f5 (MHz)	A1 (UIp-p)	A2' (UIp-p)	A2 (UIp-p)	A3' (UIp-p)	A3 (UIp-p)
9953.28M	0.1	15	600	100	2	80	0.5	4	80	100	4000

0.5 UI range: 0.000 to 0.505 UIp-p (0.001 UIp-p steps)
80 UI range: 0.00 to 80.80 UIp-p (0.05 UIp-p steps)
4000 UI range: 0 to 4040 UIp-p (2 UIp-p steps)



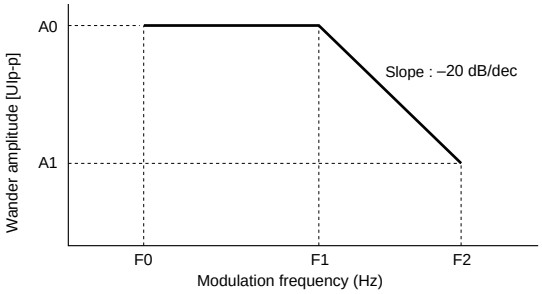
Bit rate (bit/s)	f0 (Hz)	f1 (Hz)	f2 (Hz)	f3 (kHz)	f4 (MHz)	f5 (MHz)	A1 (UIp-p)	A2' (UIp-p)	A2 (UIp-p)	A3' (UIp-p)	A3 (UIp-p)
2488.32M	0.1	15	600	100	2	20	0.5	1	20	25	1000

0.5 UI range: 0.000 to 0.505 UIp-p (0.001 UIp-p steps)
20 UI range: 0.00 to 20.20 UIp-p (0.01 UIp-p steps)
1000 UI range: 0 to 1010 UIp-p (1 UIp-p steps)

Continued on next page

Wander generation

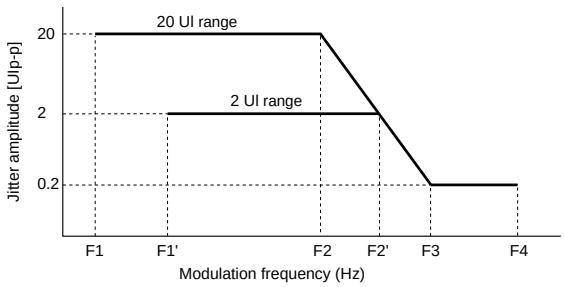
Wander generation: 10 µHz to 10 Hz, 0 to 400,000 UIp-p (1 UIp-p steps), conform to ITU-T O.172



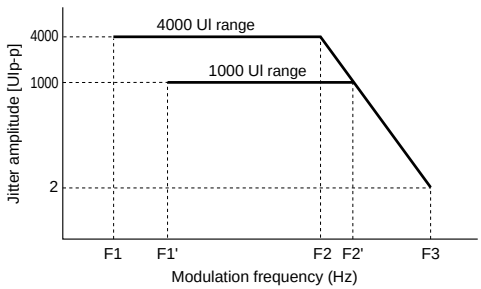
Bit rate (bit/s)	F0 (µHz)	F1 (mHz)	F2 (Hz)	A0 (UIp-p)	A1 (UIp-p)	Steps (UIp-p)
2488.32M	10	400	10	400,000	16,000	1
9953.28M	10	400	10	400,000	16,000	1

Jitter measurement

Measurement functions: UIp-p, UI + peak, UI – peak, UIrms, hit count, hit second, %F second, peak jitter
Measurement mode: Repeat, single, manual
Display: Current, last
Measurement interval: 1 to 99 s, 1 to 99 min, 1 to 99 h, 1 to 99 day
Jitter measurement: Conform to ITU-T O.172



Bit rate (bit/s)	Range (UI)	F1 (Hz)	F1' (Hz)	F2 (kHz)	F2' (kHz)	F3 (MHz)	F4 (MHz)
2488.32M	2	—	100	—	100	1	20
	20	10	—	10	—	1	20
9953.28M	2	—	100	—	400	4	80
	20	10	—	40	—	4	80



Bit rate (bit/s)	Range (UI)	F1 (Hz)	F1' (Hz)	F2 (Hz)	F2' (Hz)	F3 (kHz)
2488.32M	1000	—	1	—	12.1	5
9953.28M	4000	1	—	12.1	—	20

UIp-p measurement
2 UI range: 0.000 to 2.020 UIp-p (0.001 UIp-p steps)
20 UI range: 0.00 to 20.20 UIp-p (0.01 UIp-p steps)
1000 UI range: 0 to 1010 UIp-p (1 UIp-p steps, 2488.32 Mbit/s only)
4000 UI range: 0 to 4040 UIp-p (2 UIp-p steps, 9953.28 Mbit/s only)
UI rms measurement
2 UI range: 0.000 to 0.714 UIrms (0.001 UIrms steps)
20 UI range: 0.00 to 7.17 UIrms (0.01 UIrms steps)
Filters:
Confirming to ITU-T O.172 and Bellcore GR1377
LP, HP0 + LP, HP1 + LP, HP1' + LP, HP2 + LP, HP + LP, HP' + LP, LP' (1000/4000 UI range only),
HP0 + LP' (1000/4000 UI range only)

Bit rate (bit/s)	HP0 (Hz)	HP1 (kHz)	HP1' (kHz)	HP2 (MHz)	HP' (kHz)	HP (kHz)	LP (MHz)	LP' (kHz)
2488.32M	10	5	—	1	—	12	20	5
9953.28M	10	10	20	4	50	12	80	20

For product ordering information, see pages 4 – 10

Reference wander generation (Option 03)	Off: Able to set non-modulated status* TDEV mask: The 37 types of TDEV masks that are regulated by ITU-T, ETSI, ANSI, and Bellcore standards are available as default. It is possible to add the wander modulation on the user specified TDEV mask. Transient: It is possible to change the A $(1 - e^{-63.7t})$ phase by the timing of the start. Signal off: It is possible to disconnect the standard signal. Wander tolerance (TDEV) measurement: Evaluation by the various TDEV mask generations
Wander measurement (Option 02)	Conform to ITU-T O.172 Reference input: 2.048M (HDB3, clock), 1.544M (AMI/B8ZS, clock), 64k + 8 kHz, 5 MHz, 10 MHz Sampling frequency: 40 Hz, 1 Hz, 0.1 Hz (select by MX150002A) Measurement range P-P: 0.0 to 2E10 ns, +P/–P: 0.0 to 1E10 ns, TIE: 0.0 to ±1E10 ns Measurement time: 10 to 1 x 10^8 s (max. 120,000 s; MP1570A only) Wander application (requires MX150002A Wander Application Software) TIE: Max. 1 x 10^8 s, MTIE: Max. 1 x 10^8 s, TDEV: Max. 1 x 10^6 s Frequency offset: Measurement conforms to ANSI TI.105.09 Frequency drift rate: Measurement conforms to ANSI TI.105.09 Wander tolerance (TDEV) measurement: Evaluation by the various TDEV mask generations
Other measurement	Jitter transfer, frequency measurement, jitter tolerance, jitter sweep, frequency sweep, wander sweep (with MP1570A)
Dimensions and mass	320 (W) x 100 (H) x 350 (D) mm, ≤10 kg (with MU150018A)
Power	≤250 VA
Temperature range	0˚ to +40˚C (operating), –20˚ to +60˚C (storage)
EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)

*: Only non-modulated status can be set without this option.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name
	Main frame
MP1580A	Portable 2.5G/10G Analyzer
	Standard accessories
	AC power cord: 1 pc
F0093A	Fuse, 6.3 A: 1 pc
B0489	Front cover: 1 pc
W1889AE	MP1580A operation manual (Vol 1 Jitter/wander): 1 copy
W1890AE	MP1580A operation manual (Vol 2 Remote control): 1 copy
MX150002A	Wander Measurement Application Software (MTIE/TDEV) *Supplied with MU150018A-02: 1 pc
W1892AE	MX150002A operation manual (wander application) *Supplied with MX150002A: 1 copy
J1074	Semirigid cable Tx (for connection to MP1570A): 1 pc
J1075	Semirigid cable Rx (for connection to MP1570A): 1 pc
	Plug-in unit
MU150018A	2.5G/10G Jitter Unit
	Options
MP1580A-01	RS-232C
MP1580A-02	GPIB
MP1580A-04	VGA
MU150018A-02	Wander measurement
MU150018A-03	Wander reference output phase modulation
	Maintenance service
MP1580A-90	Extension service 3 years
MU150018A-90	Extension service 3 years
	Peripherals
MP1570A	SONET/SDH/PDH/ATM Analyzer
MP1570A-02	GPIB (requires to combine with MP1580A)
MP1570A-10*	SDH
MP1570A-11*	SONET
MU150000A	2.5G/10G Unit (electrical for MP1570A)
MU150001A	Optical 10G Tx (1.55) Unit *2 km, for MP1570A
MU150001B	Optical 10G Tx (1.55) Unit *40 km, for MP1570A
MU150001A/B-01	2.5G (1.31, option for MP1570A)
MU150001A/B-02	2.5G (1.55, option for MP1570A)
MU150001A/B-03	2.5G (1.31/1.55, option for MP1570A)
MU150017A	Optical 10G Rx (Wide) Unit *For MP1570A
MU150017B	Optical 2.5G/10G Rx (Wide) Unit *For MP1570A
MP9677B	E/O, O/E Converter
MU967701A	Clock Recovery Unit (9953.28 MHz) *For MP9677B
MP35A	Matching Transformer (BNC-J/Siemence, C42334-A282, 75/120 Ω)

Model/Order No.	Name
	Optical accessories
J0661A	RS232C cable (cross cable with D-sub 9 pin connector at both ends), 2 m
J0006	GPIB cable, 0.5 m
J0007	GPIB cable, 1 m
J0008	GPIB cable, 2 m
J0696A	Coaxial cord (AA-165-500), 0.5 m
J0696C	Coaxial cord (AA-165-1000), 1 m
J0900E	Coaxial cord (AA-165-1500), 1.5 m
J0162A	Balanced cord (Siemence 3P · Siemence 3P) 1 m
J0162C	Balanced cord (Siemence 3P · Siemence 3P), 2 m
J0845A	Balanced cord, (Bantam 3P · Bantam 3P), 6 ft
J0775D	Coaxial cord (BNC-P620 · 3C-2WS · BNC-P620, 75 Ω), 2 m
J0776D	Coaxial cord (BNC-P-3W · 3D-2W · BNC-P-3W, 50 Ω), 2 m
B0490	Joint plate (to mount MP1580A and MP1570A in a stack)
B0491	Soft case
B0492	Hard carrying case

*: Must specify SDH (Option 10) or SONET (Option 11) when ordering depends on your systems. The option price is included in the MP1570A. These two options can be installed simultaneously. But in this case, one option is charged.

DATA QUALITY ANALYZER
MD1230A

Complete Performance Testing and Monitoring with One Unit

NEW

IP Networks are spreading rapidly throughout society in line with the expansion of networks carrying voice, video, and mission-critical data. And now maintenance of network quality has become an important theme.
Development of network equipment and systems requires the measurement of network performance and QoS evaluations. In addition, network operations and maintenance require monitoring of in-service traffic, latency, and frame arrival time variation (frame jitter) as well as prompt troubleshooting.
The MD1230A integrates both performance testing and network monitoring into one instrument.

Applications

• R&D

RFC2544 test
The six standard RFC1242 and RFC2544 tests: Throughput, Latency, Frame Loss Rate, Back-to-Back-Frame, System Recovery, and Reset, can be performed automatically with the results displayed graphically or in table form. The test efficiency has been improved through automation.

BGP4 link flap/route flap test
The MD1230A can emulate the BGP4 (Border Gateway Protocol version 4) speaker for a maximum of 8 devices. It can also perform link flap tests for neighboring routers and route flap tests for up to 800 routes. (However, it cannot use routes advertised by the DUT in the route flap test.)

• Manufacturing

Automated testing using GPIB commands (MD1230A Option 02)
Preset test items for production lines of network devices, etc., can be executed automatically and the measurement results saved. The MD1230A supports GPIB commands and almost all its functions can be executed via GPIB. In addition, several MD1230As can be controlled from one controller. Since the automated control programs use well-known GPIB commands, users' development costs of application software can be saved.

• Maintenance

VPN QoS traffic monitoring
Since traffic can be measured according to 8 priority levels based on the VLAN tag user priority field specified by IEEE802.1D and the least 3 bits of the DSCP field specified by RFC2474, it is also possible to measure QoS traffic for other packets not generated by the MD1230A.
If user-defined filters are used, VoIP traffic (specified UDP port number) to which specific MPLS labels are appended can be measured in real time.

Protocol analysis
Layer 2 to Layer 4 protocol decode can be performed on captured packets. Any problems with frame transportation are basically covered by the MD1230A protocol decode function of Layer 2 to Layer 4.

Remote latency (MD1230A Option 05)
The MD1230A has an optional GPS function and it can perform time synchronization with remote MD1230A units to measure frame latency of a long distance. Moreover, the capture function can be triggered when the measured latency exceeds the user setting. At present, there are services for guaranteeing VPN latency but if these services develop a fault, the MD1230A is very helpful.

Functions

• Physical interface for 10 Mbit/s to 10 Gbit/s
The MD1230A has the interface modules shown in the table below, and other interface modules will be added to the list. The Gigabit Ethernet Module has a Giga-Bit Interface Converter (GBIC) that can be changed to support 1000BASE-SX/LX/LH/ZX ports.

10/100M Ethernet Module	8 ports
Gigabit Ethernet Module	2 ports
2.5G (1.31) Module	1 port
2.5G (1.55) Module	1 port
10G (1.31) Module	1 port
10G (1.55) Module	1 port

For product ordering information, see pages 4 – 10

• Expandable to 320 ports (100BASE-TX)

Any combination of five interface modules can be installed in the MD1230A. Moreover, a maximum of eight MD1230A units can be daisy chained via Ethernet with one unit acting as a controller for all units. Furthermore, time synchronization is performed by connecting a clock to the daisy chain. Latency between any ports can be measured. The number of ports can be expanded up to a maximum of 320 by using the 10M/100M Ethernet module.

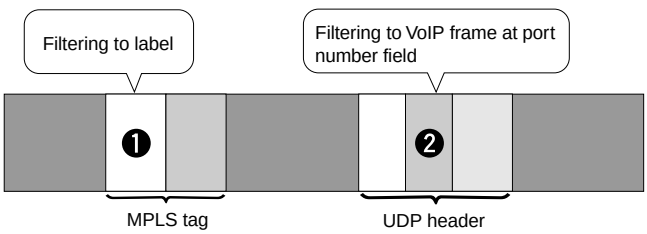
Module	10M/100M Ethernet	Gigabit Ethernet	2.5G	10G
No. of ports/module	8	2	1	1
No. of modules/unit	5	5	5	5
No. of ports/unit	40	10	5	5
No. of ports for 8 connections	320	80	40	40

• Powerful and flexible filter/trigger conditions

The MD1230A has powerful and flexible filter and trigger functions that can be set independently for each port as shown in the following table.

Trigger condition	Filter condition	Condition	Remarks
√	√	Destination MAC address	10M/100M Ethernet and Gigabit Ethernet support those conditions. MAC address mask permits portion match.
√	√	Source MAC address	
√	√	Destination IP address	2.5G (1.31), 2.5G (1.55), 10G (1.31), 10G (1.55) support those conditions. IP address mask permits portion match
√	√	Source IP address	
√	√	User-defined 32 bit pattern	Two sets of user-defined 32 bit pattern conditions per port. Sets offset and pattern match at any frame position. Pattern mask permits portion match.
√	√	User-defined 32 bit pattern	
√	√	Error condition	Good frame, FCS error, undersize, fragment, oversize, oversize/FCS error, dribble error, alignment error, IP header checksum error, TCP header checksum error, UDP header checksum error
√	√	Ext. trigger input	Rising edge of pulse
√	—	Traffic over	When traffic setting overflows
√	—	Latency over	When latency setting overflows

As an example, when filtering only VoIP frames on an MPLS network, the MPLS label is specified as a 32 bit pattern (1), and VoIP frames are specified at the UDP header port number field as a 32 bit pattern (2). As a result, if only VoIP frames are captured on the specified MPLS network, the number of packets can be counted.



• Support for MPLS, IPv6, BGP4, etc., protocol decode

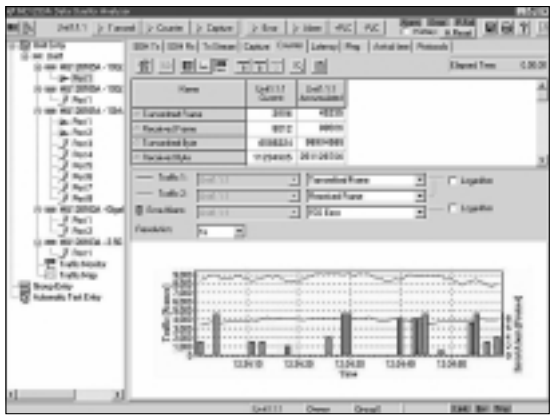
The 256 Mbyte max. capture buffer does not drop frames even at the full wire rate of 10 Gbit/s. The in-service capture function is an especially powerful and useful tool for troubleshooting the causes of network faults. Captured frames can be searched on the basis of specified conditions and interesting frames can be selected and displayed. Each port has an independent capture buffer and is unaffected by other ports.

Moreover, each of the Ethernet, PPP, LCP, MPLS, VLAN, ARP, IPv4, ICMP, IPv6, TCP, UDP, IGMP, RIP, BGP4 and DHCP protocols can be decoded and displayed for captured frames. When 10M/100M Ethernet and Gigabit Ethernet, IPX can be decoded.

• Real-time measurement of in-service traffic

Traffic monitoring

The MD1230A can measure send and receive byte/frame counts, QoS frame counts in 8 priority ranks, counts of each error type, count of SONET/SDH alarms, etc., in real time. In addition, when the above-described filter function is used, specific frame traffic can be measured for each port. This is an extremely powerful function — for example, in VPN services, specific MPLS VoIP frames (specified by UDP port number) can be extracted.



Latency

The MD1230A is able to measure the latency of simplex data transfer. When up to eight MD1230A units are daisy chained, latency can be measured by interconnecting a clock signal for time synchronization. In addition, when a GPS antenna is connected, latency can be measured between remote locations.

• Full wire rate transmission of user-edited data stream

The MD1230A can send a maximum of 256 data streams per port at the full wire rate. Data editing is a simple three-step procedure described below.

Step 1: Setting frame data

The frame editor is used to edit the frame data for any of the Ethernet, PPP, Cisco HDLC, ARP, IPv4, IPv6, IPX, MPLS, VLAN, TCP, UDP, IGMP, RIP and DHCP protocols. The protocol header format is displayed on screen, and header input by the user is also supported. Part or all of the IP address and MAC address can be set to increment, decrement or random. When IPv6, IP address portion of 32 bits less can be set to increment, decrement or random.

Step 2: Setting stream control
The interval gap of the frame set in step 1 is set and the data stream is defined. Commonly, an actual network load is not a stationary load but a burst load. To simulate this type of load, the MD1230A has a multi-burst function. In addition, a random frame interval can be simulated by setting to random within a specified packet interval range.

Step 3: Combining Data Stream
Up to 256 data streams defined in step 2 can be combined per port. Any number of data streams can also be repeated a specified number of times.

• Compact and lightweight unit with built-in Windows®98 OS
For easy and familiar operability, the MD1230A uses the built-in Windows®98. In addition, it also has a USB port for connecting a printer or external storage media. A PS/2 keyboard connector and USB connector on the front panel support connection of a keyboard and USB mouse. The MD1230A's easy operability, compact size and lightweight offer the perfect solution for convenient on-site troubleshooting.

• Remote control from PC
When the MX123001A Data Quality Analyzer Control Software (sold separately) is installed in a PC running Windows®98, up to eight MD1230A units can be controlled via a network.

• Automated measurement using GPIB commands (Option)
Almost all the MD1230A functions can be executed by GPIB commands. An automated test system can be configured by operating the MD1230A from the user's application software. In addition, the interface for sending and receiving GPIB commands can be selected from any of the optional GPIB (MD1230A Option 02), RS-232C (MD1230A Option 01) and Ethernet (MD1230A Option 03) interfaces.

Specifications

• MD1230A (main frame)

Sync clock input	Frequency: 64 kHz + 8 kHz ±50 ppm, 2.048 MHz ±50 ppm, 1.544 MHz ±50 ppm, 2.048 Mbit/s ±50 ppm, 1.544 Mbit/s ±50 ppm Interface 2M: ITU-T G.703 Table 10, HDB3 1.5M: B8ZS, AMI ANSI T1.403 Level (64k): 0.63 to 1.1 Vo-p Code (64k): AMI with 8 kHz violation Connector BNC (75 Ω): 2 MHz, 2 Mbit/s Siemens (120 Ω, balanced): 2 MHz, 2 Mbit/s, 64 kHz + 8 kHz Bantam (100 Ω, balanced): 1.5 MHz, 1.5 Mbit/s
Trigger output	Level: TTL (active high), impedance: 75 Ω (BNC)
Trigger input	Usable as capture buffer trigger Level: TTL (Active high), connector: 75 Ω (BNC)
Sync I/O	MD1230A time sync signal, impedance: 75 Ω (BNC)
Interfaces	RS-232C, GPIB (Option 02), Ethernet (10BASE-T/100BASE-TX), USB port x 2 , PS/2 keyboard connector, GPS antenna (option 05), video output (VGA)
Built-in memory	Measurement conditions: 10 sets, Measurement results: 10 sets
External storage	3.5" FDD
OS	Windows® 98 Second Edition
Auto test	RFC2544 Tests (throughput, latency, frame loss rate, back-to-back frame, system recovery, reset)
Traffic monitor	Ethernet frame count for max. 64 flow, IP packet count for max. 64 flow, frame count for each protocol
Traffic map	Ethernet data flow for max. 64 flow, IP data flow for max. 64 flow
LEDs	Power fail, errors, alarms, remote, local, HDD, power
Dimensions and mass	320 (W) x 177 (H) x 350 (D) mm, ≤15 kg (excluding options and modules)
Power supply	85 to 132 Vac/170 to 250 Vac (auto switching), 47.5 to 63 Hz, ≤530 VA
Relative humidity	0˚ to +40˚C (except when HDD or FDD are active.)
EMC	EN61326: 1997/A1: 1998 (Class A), EN61000-3-2: 1995/A2: 1998 (Class A), EN61326: 1997/A1: 1998 (Annex A)
LVD	EN61010-1: 1993/A2: 1995 (Installation Category Ⅱ, Pollution degree 2)

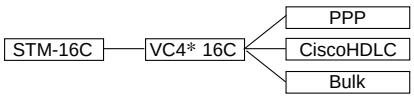
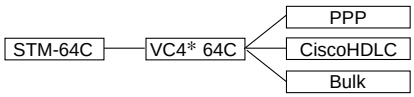
For product ordering information, see pages 4 – 10

• Ethernet Module

Model	MU120101A	MU120102A
Ports	10BASE-T/100BASE-TX Number of ports: 8 Connector: RJ-45 Link speed: 10/100 Mbit/s Duplex mode: Full, half Auto negotiation: On/off Flow control: On/off	1000BASE-SX/LX/LH/ZX*1 Number of ports: 2 Connector: SC Link speed: 1000 Mbit/s Duplex mode: Full Auto negotiation: On/off Flow control: On/off
LEDs	Link, Tx/collision, Rx/error	Link, Tx, Rx/error
Frame settings	MAC address: Fixed, increment, decrement, random (changeable parts specified in nibble units) VLAN tag*2: Fixed, increment, decrement, random MPLS label*2: Up to 10 MPLS labels can be appended. Fixed setting Protocol editing: IPv4, IPv6, TCP, UDP, IGMP, ICMPv4, RIP, DHCP, IPX, ARP, pause control Data field: Can set any 4 parts in data field All 1s, all 0s, alternate 1/0 (each bit, each 2 bits, each nibble, each byte, each 2 bytes), increment, decrement, random, user programmed, single PRBS9, time stamp, sequence number, test frame	
Frame length	18 to 10,000 bytes (settable as auto, fixed, increment, or random)	48 bytes to 64 kbytes (settable as auto, fixed, increment, or random)
Stream settings	Stream transport mode: Continuous, continuous burst, stop after this stream, next stream, jump to stream. Jump to stream for count (loop count: 1 to 16000000, frame count per burst: 1 to 16000000, burst count per stream: 1 to 16000000)	
Stream settings	Inter frame gap 10BASE-T: 8000 ns to 170 s, resolution at 800 ns, settable as fixed, random 100BASE-TX: 800 ns to 170 s, resolution at 80 ns, settable as fixed Inter burst gap 10BASE-T: 8000 ns to 170 s, resolution at 800 ns, settable as fixed 100BASE-TX: 800 ns to 170 s, resolution at 80 ns, settable as fixed Inter stream gap 10BASE-T: 8000 ns to 170 s, resolution at 800 ns, settable as fixed 100BASE-TX: 800 ns to 170 s, resolution fixed at 80 ns, settable as fixed	Inter frame gap: 64 ns to 120 s, resolution at 16 ns, settable as fixed, random Inter burst gap: 64 ns to 120 s, resolution at 16 ns, settable as fixed Inter stream gap: 64 ns to 120 s, resolution at 16 ns, settable as fixed
Number of stream	256 streams/port	
Error insertion	Collision, FCS error, dribble bit error, undersize error, oversize error, fragments error, oversize/FCS error, IP header checksum error, TCP/UDP header checksum error	FCS error, undersize error, oversize error, fragments error, oversize/FCS error, IP header checksum error, TCP/UDP header checksum error
Counter	Transmitted frame, received frame, transmitted bytes, received bytes, fragments, undersize, oversize, oversize/bad CRC, FCS error, line error, flow control, alignment error, dribble bit error, collision, capture trigger, capture filter, transmitted ARP reply, transmitted ARP request, transmitted ping reply, transmitted ping request, received ARP reply, received ARP request, received ping reply, received ping request, QoS 0 to 7, user defined 1, user defined 2, transmitted IP, received IP, IP checksum error, TCP checksum error, UDP checksum error	Transmitted frame, received frame, transmitted bytes, received bytes, fragments, undersize, oversize, oversize/bad CRC, FCS error, line error, flow control, byte alignment error, capture trigger, capture filter, transmitted ARP reply, transmitted ARP request, transmitted ping reply, transmitted ping request, received ARP reply, received ARP request, received ping reply, received ping request, QoS 0 to 7, user defined 1, user defined 2, transmitted IP, received IP, IP checksum error, TCP checksum error, UDP checksum error
Latency	Maximum, minimum, average measure	
Frame arrival time variation measurement	Time resolution: 1 µs, 10 µs, 100 µs, 1 ms, 10 ms, 100 ms, 1 s	
QoS counter setting	Using QoS described below, 8-level priority frame count: IEEE802.1D VLAN tag user priority field, least 3 bits of RFC2474 DSCP field	
Capture buffer	8 Mbytes/port	32 Mbytes/port
Capture filter	At following conditions for each port, capture filter condition settings: Destination MAC address, source MAC address, 32-bit pattern (settable bit length and offset) x 2, error conditions	
Capture trigger	At following conditions for each port, capture trigger condition settings: Destination MAC address, source MAC address, 32-bit pattern (settable bit length and offset) x 2, error conditions, traffic over, latency over, external trigger input	
Protocol decode	Ethernet, MPLS, VLAN, ARP, IPX, IPv4, ICMP, IPv6, TCP, UDP, IGMP, RIP, BGP4, DHCP	
Protocol emulate	ARP, PING, IGMP, BGP4	

∗1: 1000BASE-SX/LX/LH/ZX can be chosen by exchanging GBIC that is a optional accessories.
∗2: Both VLAN tag and MPLS labels can not be used simultaneously.

• POS Module

Model	MU120103A	MU120104A	MU120105A	MU120106A
Ports	OC-48/STM-16 Wavelength: 1260 to 1360 nm Number of port: 1 Connector: SC Bit rate: 2488.320 Mbit/s (NRZ) Output level: –5 to 0 dBm Input sensitivity: –18 to 0 dBm	OC-48/STM-16 Wavelength: 1500 to 1580 nm Number of port: 1 Connector: SC Bit rate: 2488.320 Mbit/s (NRZ) Output level: –1.0 to +2.0 dBm Input sensitivity: –28 to –9 dBm	OC-192/STM-64 Wavelength: 1290 to 1330 nm Number of port: 1 Connector: SC Bit rate: 9953.280 Mbit/s (NRZ) Output level: –6 to 0 dBm Input sensitivity: –11 to –1.0 dBm	OC-192/STM-64 Wavelength: 1530 to 1565 nm Number of port: 1 Connector: SC Bit rate: 9953.280 Mbit/s (NRZ) Output level: –1.0 to +2.0 dBm Input sensitivity: –14 to –3.0 dBm
LEDs	Link, Tx, Rx/error, optical send			
Clocks	Internal (MU120103A/120104A : ±50 ppm variable, MU120105A/120106A : ±100 ppm), receive signal, lock (64 kHz + 8 kHz, 1.5 MHz, 2 MHz, 1.5 Mbit/s, 2 Mbit/s)			
SDH/SONET settings	Frame: SDH/SONET Alarm addition: LOS, LOF, MS-AIS, MS-RDI, MS-TIM, AU-AIS, AU-LOP, HP-SLM, HP-TIM, HP-RDI, HP-UNEQ Timing: Single, single burst frame, alternative [alarm frame (0 to 8000), Normal frame (0 to 8000)], all Error insertion: FAS, bits all, B1, B2, B3, MS-REI, HP-REI Timing: Single, single burst bit (1 to 64000), rate (1E-3, 1E-4, 1E-5, 1E-6, 1E-7, 1E-8, 1E-9), programmed rate [AE-B ∗A: 1.0 to 9.9 (0.1 steps), B: 3 to 10] APS (K1/K2) Sequence generation: 2 to 64 words, repeat (8000 frames)			
Mapping				
Frame settings	PPP scramble: On/off PPP FCS: CRC32 MPLS label: Up to 10 MPLS labels can be appended. Fixed setting Protocol editing: IPv4, IPv6, TCP, UDP, IGMP, ICMPv4, RIP, DHCP Data field: Can set any 4 parts in data field. All 1s, all 0s, alternate 1/0 (each bit, each 2 bits, each nibble, each byte, each 2 bytes), increment, decrement, random, user programmable, single PRBS9, time stamp, sequence number, test frame			
Frame length	8 bytes to 64 kbytes (settable as auto, fixed, increment, or random)			
Stream settings	Stream transport mode: Continuous, continuous burst, stop after this stream, next stream, jump to stream. Jump to stream for count (loop count: 1 to 16000000, frame count per burst: 1 to 16000000, burst count per stream: 1 to 16000000)			
	Inter frame gap: 3.2 ns to 120 s, resolution at 3.2 ns, settable as fixed, random Inter burst gap: 3.2 ns to 120 s, resolution at 3.2 ns, settable as fixed Inter stream gap: 3.2 ns to 120 s, resolution at 3.2 ns, settable as fixed		Inter frame gap: 0.8 ns to 120 s, resolution at 0.8 ns, settable as fixed, random Inter burst gap: 0.8 ns to 120 s, resolution at 0.8 ns, settable as fixed Inter stream gap: 0.8 ns to 120 s, resolution at 0.8 ns, settable as fixed	
Number of streams	256 streams/port			
Error insertion	FCS error, abort frame, fragment, undersize, IP header checksum error, TCP/UDP header checksum error			
Counter	SONET/SDH: B1, B2, B3, HP-IEC, MS-REI, HP-REI, LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-SLM, HP-TIM, HP-RDI, HP-UNEQ Justification: NDF, +PJC, –PJC PPP/IP/TCP/UDP: Transmitted frame, received frame, transmitted bytes, received bytes, received bytes before stuffing, transmitted bytes after stuffing, fragment, undersize, oversize, FCS error, abort error, capture trigger, capture filter, transmitted ping reply, transmitted ping request, received ping reply, received ping request, QoS 0 to 7, user defined 1, user defined 2, transmitted IP, received IP, IP checksum error, TCP checksum error, UDP checksum error			
Latency	Maximum, minimum, average			
Alarm arrival time variation measurement	Time resolution: 1 µs, 10 µs, 100 µs, 1 ms, 10 ms, 100 ms, 1 s			
QoS counter settings	Using least 3 bits of RFC2474 DSCP field, 8-stage priority packet count			
Capture buffer	64 Mbytes		256 Mbytes	
Capture filter	At following conditions for each port, capture filter condition settings: Destination IP address, source IP address, 32-bit pattern (settable bit length and offset) x 2, error conditions			
Capture trigger	At following conditions for each port, capture trigger condition settings: Destination IP address, source IP address, 32-bit pattern (settable bit length and offset) x 2, error conditions, traffic over, latency over, external trigger input			
Protocol decode	PPP, LCP, IPCP, MPLS, IPv4, ICMPv4, IPv6, TCP, UDP, IGMP, RIP, BGP4, DHCP			
Protocol emulate	PING, IGMP, BGP4			

For product ordering information, see pages 4 – 10

Ordering information

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MD1230A	Data Quality Analyzer	
	Standard accessories	
	Power cord, 2.5 m:	1 pc
F0079	Fuse, 10 A:	2 pcs
B0329G	Front cover (for 3/4MW4U):	1 pc
B0500A	Side cover:	1 pc
W1930AE	MD1230A operation manual (CD-ROM)*1:	1 pc
	Options	
MD1230A-01	RS-232C control	
MD1230A-02	GPIB control	
MD1230A-03	Ethernet control	
MD1230A-05	GPS module	
	Software	
MX123001A	Data Quality Analyzer Control Software	
	Plug-in modules	
MU120101A	10M/100M Ethernet Module	
MU120102A	Gigabit Ethernet Module*2	
MU120103A	2.5G (1.31) Module	
MU120104A	2.5G (1.55) Module	
MU120105A	10G (1.31) Module	
MU120106A	10G (1.55) Module	
	Maintenance service*3	
MD1230A-90	Extension service 3 years	
MU120101A-90	Extension service 3 years	
MU120102A-90	Extension service 3 years	
MU120103A-90	Extension service 3 years	
MU120104A-90	Extension service 3 years	
MU120105A-90	Extension service 3 years	
MU120106A-90	Extension service 3 years	
	Optional accessories	
G0105A	GBIC SX 850 nm*4	
G0106A	GBIC LX 1310 nm*4	
G0107A	GBIC LH 1310 nm*4	
G0108A	GBIC ZX 1550 nm*4	
J0788B	Optical fiber cord (SM, SC-SC connector both ends), 2 m	
J0773B	Optical fiber cord (GI, SC-SC connector both ends), 2 m	
J1119B	Optical fiber cable (duplex, MM), 2 m	
J1110B	LAN cable (straight, 5 m)	
J1109B	LAN cable (cross, 5 m)	
J0755D	Coaxial cord (BNC-P620 · 3C-2WS · BNC-P620, 75 Ω), 2 m	
J0162B	Balanced cable (Siemens 3p-Siemens 3p), 2 m	
J0845A	Balanced cable (BANTAM 3P/BANTAM 3P), 6 ft	
J0008	GPIB cable, 2 m	
B0448	Soft case	
B0336C	Carrying case (for 3/4MW4U, 350D)	
Z0321A	Keyboard (PS/2)	
Z0541A	Mouse	
J0149A	Fixed optical attenuator (SC, 5 dB)	
J0149B	Fixed optical attenuator (SC, 10 dB)	
J0149C	Fixed optical attenuator (SC, 15 dB)	
B0501B	Blank panel	
W1927AE	MD1230A operation manual	
W1929AE	MD1230A remote control operation manual	
W1928AE	MX123001A software operation manual	

∗1: Includes W1927AE, W1928AE and W1929AE operation manuals. Printed version sold separately.
∗2: MU120102A requires two GBIC modules (sold separately).
∗3: Please ask your local Anritsu Field Office or Sales Representative for price and availability.
∗4: GBIC module is sold per one piece. MU120102A has two GBIC interface.

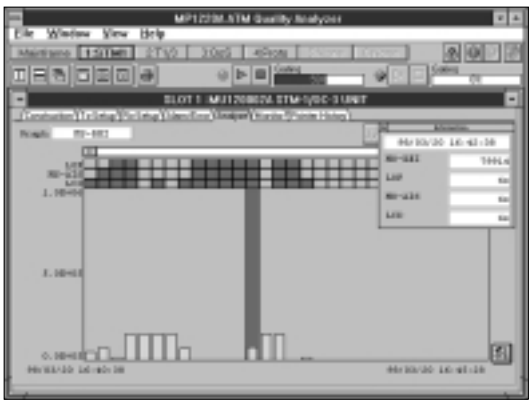
ATM QUALITY ANALYZER
MP1220B
1.5 Mbps (T1) to 622 Mbps (STM-4c/OC-12c)

For Construction and Maintenance of ATM Networks

The MP1220B is a portable measuring instrument for ATM networks; it can measure the PDH/SDH physical layer, the ATM layer, and the AAL. It is the perfect instrument for troubleshooting ATM networks during construction and maintenance and has a wide range of convenient applications in manufacturing inspection of ATM devices.

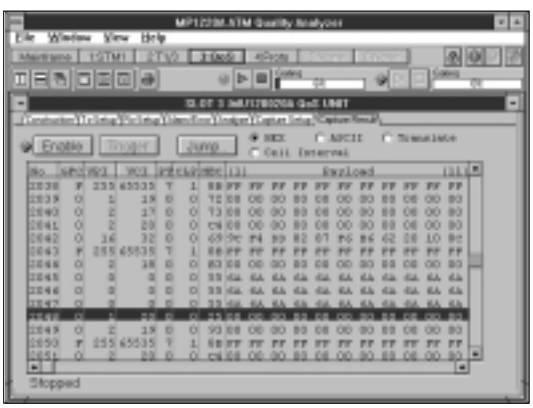
Features

- Supports various interfaces from 1.5 Mbps (T1) to 622 Mbps (STM-4c/OC-12c) SONET and SDH
- Simultaneous measurement and real-time analysis up to the ATM-CPCS layer of two channels(up/down stream)
- Automated traffic monitoring of 1,023 network channels for bandwidth utilization
- Uses formatted payload data conforming to ITU-O.191 recommendations for cell delay performance measurements
- Small, lightweight, rack mount or portable
- Supports a variety of remote control testing configurations
- Online manuals and online help



Graphical display of alarm/error history

Measurement items for test cells



Cell capture display (hexadecimal)

For product ordering information, see pages 4 – 10

Automatic evaluation and measurement of AAL type for 1023 channels

Specifications

• MP1220B ATM Quality Analyzer

Display	10.4 inch TFT color LCD with touch panel (analog resistive membrane)
Memory storage	3.5 inch floppy disk drive (1.44 MB/720 KB) and hard disk drive (≥500 MB)
Buzzer	Alarm, error
External interface	RS-232C (D-sub 9-pin), printer (Centronics, D-sub, 25-pin), keyboard (PS/2, mini-DIN, 6-pin), mouse (PS/2, mini-DIN, 6-pin), VGA (analog RGB, D-sub, 15-pin)
Slots	6 (two channels max.)
EMC	EN55011: 1991, Group 1, Class A EN50082-1: 1992 Harmonic current emissions; EN61000-3-2: 1995, Class D
Safety	EN61010-1: 1993 (Installation Category Ⅱ, Pollution Degree Ⅱ)
Dimensions and mass	284 (W) x 221.5 (H) x 365 (D) mm, ≤12 kg (excluding units)
Power supply	100 to 120/200 to 240 Vac (autoswitching), 50 to 60 Hz, ≤300 VA
Operating range	Operating: 5˚ to 50˚C (excluding FDD), Storage: –20˚ to 60˚C

• MU120001A STM-4/OC-12 Unit

Bit rate	51.84, 155.52, 622.08 Mbps
Frames	SDH/SONET
Output signal	Connector: FC (replaceable), 1.31 µm band (SM) Clock: Internal (±10 ppm), external, receive Level: –15 to –8 dBm Code: NRZ Optical safety: IEC825-1 Class 1, 21CFR1040.10 Class I
Input signal	Connector: FC (replaceable), 1.31 µm band (SM) Frequency range: ±100 ppm Level: –34 to –8 dBm (51.84 Mbps, 155.52 Mbps), –28 to –8 dBm (622.08 Mbps) Code: NRZ
Functions	SOH/POH setting, SOH/POH monitoring, path trace, empty cell setting, cell scramble (de-scramble) on/off, coset on/off, HEC error correction on/off Error addition: Bit, B1, B2, B3, FEBE-L, FEBE-P, cell Alarm addition: LOS, LOF, AIS-L, RDI-L, AIS-P, RDI-P, LCD Error measurement: B1, B2, B3, MS-REI (FEBE-L), HP-REI (FEBE-P), HEC corrected cells, HEC uncorrected cells Alarm measurement: LOS, OOF, LOF, MS-AIS (AIS-L), MS-RDI (RDI-L), AU-AIS (AIS-P), HP-RDI (RDI-P), AU-LOP (LOP-P), LCD Pointers: Monitor, ±justification, NDF Auxiliary output: Receive clock output, trigger output

• MU120002A STM-1/OC-3 Unit

Bit rate	155.52 Mbps
Frames	SDH/SONET
Output signal	Connector Optical: SC 1.31 µm (SM); Electrical: BNC 75 Ω Clock: Internal (±10 ppm), external, receive Optical level: –15 to –8 dBm Electrical level: 1 ±0.1 Vp-p (CMI) Code Optical: NRZ, Electrical: CMI Optical safety: IEC825-1 Class 1, 21CFR1040.10 Class I

Continued on next page

Input signal	Connector Optical: SC 1.31 µm (SM/MM); Electrical: BNC 75 Ω Frequency range: ±100 ppm Optical level: –28 to –8 dBm (SM) Electrical level: 1 ±0.1 Vp-p (CMI) ∗Cable loss: 0 to 12 dB, Monitor: 20 dB attenuated level of above level can be applied. Code Optical: NRZ; Electrical: CMI
Functions	SOH/POH setting, SOH/POH monitoring, path trace, empty cell setting, cell scramble (de-scramble) on/off, coset on/off, HEC error correction on/off Error addition: Bit, B1, B2, B3, FEBE-L, FEBE-P, cell Alarm addition: LOS, LOF, AIS-L, RDI-L, AIS-P, RDI-P, LOP-P, LCD Error measurement: B1, B2, B3, MS-REI (FEBE-L), HP-REI (FEBE-P), HEC corrected cells, HEC uncorrected cells Alarm measurement: LOS, OOF, LOF, MS-AIS (AIS-L), MS-RDI (RDI-L), AU-AIS (AIS-P), HP-RDI (RDI-P), AU-LOP (LOP-P), LCD Pointers: Monitor, ±justification, NDF, history record Auxiliary output: Receive clock output, trigger output

• MU120010A T1/T3 Unit

Bit rate	1.544 Mbps (T1), 44.736 Mbps (T3)
Frames	1.5M ESF (PLCP: on/off), 45M C-bit parity (PLCP: on/off), 45M M23 (PLCP: on/off)
Output signal	Connector BNC: 75 Ω unbalanced (T3); 8-pin modular: 100 Ω balanced (ISO/IEC 10173, T1) Clock: Internal (±10 ppm), external, receive Level: 2.4 to 3.6 Vo-p (T1), 0.36 to 0.85 Vo-p (T3) Code T1: B8ZS, T3: B3ZS
Input signal	Connector BNC: 75 Ω unbalanced (T3); 8-pin modular: 100 Ω balanced (ISO/IEC 10173, T1) Frequency range: ±130 ppm (T1), ±20 ppm (T3) Level: 2.4 to 3.6 Vo-p (T1), 0.36 to 0.85 Vo-p (T3) ∗Monitor: 20 dB attenuated level of above level can be applied. Code T1: B8ZS, T3: B3ZS
Functions	Empty cell setting, cell scramble (de-scramble) on/off, coset on/off, HEC error correction on/off Error addition: Bit, FEBE, PLCP-BIP-8, PLCP-FEBE, cell Alarm addition: LOF, LOS, AIS, yellow, idle, PLCP-LOF, PLCP-yellow, LCD Error measurement: Code, CP, FEBE, CRC6, PLCP-BIP-8, PLCP-FEBE, HEC corrected cells, HEC uncorrected cells Alarm measurement: LOS, OOF, AIS, yellow, idle, PLCP-OOF, PLCP-yellow, LCD Auxiliary output: Receive clock output, trigger output

• MU120011A E1/E3/E4 Unit

Bit rate	2.048 Mbps (E1), 34.368 Mbps (E3), 139.264 Mbps (E4)
Frames	2M-CRC-4 off (PLCP: on/off), 2M CRC4 on (PLCP: on/off), 34M G.751 (PLCP: on), 34M GH.832 (PLCP: off), 139M G.832 (PLCP: off)
Output signal	Connector D-sub (9-pin): 120 Ω balanced (E1); BNC: 75 Ω unbalanced (E1/E3/E4) Clock: Internal (±10 ppm), external, receive Level: 3 ±0.3 Vo-p (E1 balanced), 2.37 ±0.237 Vo-p (E1 unbalanced), 1 ±0.1 Vo-p (E3), 1 ±0.1 Vp-p (E4) Code E1/E3: HDB3, E4: CMI
Input signal	Connector D-sub (9-pin): 120 Ω balanced (E1); BNC: 75 Ω unbalanced (E1/E3/E4) Frequency range: ±100 ppm (E1/E4), ±20 ppm (E3) Level: 3 ±0.3 Vo-p (E1 balanced), 2.37 ±0.237 Vo-p (E1 unbalanced), 1 ±0.1 Vo-p (E3), 1 ±0.1 Vp-p (E4) ∗Cable loss: 0 to 6 dB (E1), 0 to 12 dB (E3, E4), Monitor: 20 dB attenuated level of above level can be applied. Code E1/E3: HDB3, E4: CMI
Functions	Empty cell setting, cell scramble (de-scramble) on/off, coset on/off, HEC error correction on/off (E1, E3) Error addition: Bit, BIP-8, REI, PLCP-BIP-8, PLCP-FEBE, cell Alarm addition: LOF, LOS, AIS, RA, RA (MF), RDI, PLCP-LOF, PLCP-yellow, LCD Error measurement: CRC4, code, BIP-8, REI, PLCP-BIP-8, PLCP-FEBE, HEC corrected cells, HEC uncorrected cells Alarm measurement: LOS, OOF, AIS, MF loss (CRC), MF loss (sig), RA, RA (MF), RDI, PLCP-OOF, PLCP-yellow, LCD Trail trace: Monitor, setting Auxiliary output: Receive clock output, trigger output

• MU120012A E1/E3 Unit

Bit rate	2.048 Mbps (E1), 34.368 Mbps (E3)
Frames	2M-CRC-4 off (PLCP: on/off), 2M CRC4 on (PLCP: on/off), 34M G.751 (PLCP: on), 34M G.832 (PLCP: off)
Output signal	Connector D-sub (9-pin): 120 Ω balanced (E1); BNC: 75 Ω unbalanced (E1/E3) Clock: Internal (±10 ppm), external, receive Level: 3 ±0.3 Vo-p (E1 balanced), 2.37 ±0.237 Vo-p (E1 unbalanced), 1 ±0.1 Vo-p (E3) Code: HDB3

Continued on next page

Input signal	Connector D-sub (9-pin): 120 Ω balanced (E1); BNC: 75 Ω unbalanced (E1/E3) Frequency range: ±100 ppm (E1), ±20 ppm (E3) Level: 3 ±0.3 Vo-p (E1 balanced), 2.37 ±0.237 Vo-p (E1 unbalanced), 1 ±0.1 Vo-p (E3) ∗Cable loss: 0 to 6 dB (E1), 0 to 12 dB (E3), Monitor: 20 dB attenuated level of above level can be applied. Code: HDB3
Functions	Empty cell setting, cell scramble (de-scramble) on/off, coset on/off, HEC error correction on/off Error addition: Bit, BIP-8, REI, PLCP-BIP-8, PLCP-FEBE, cell Alarm addition: LOF, LOS, AIS, RA, RA (MF), RDI, PLCP-LOF, PLCP-yellow, LCD Error measurement: CRC4, code, BIP-8, REI, PLCP-BIP-8, PLCP-FEBE, HEC corrected cells, HEC uncorrected cells Alarm measurement: LOS, OOF, AIS, MF Loss (CRC), MF Loss (Sig), RA, RA (MF), RDI, PLCP-OOF, PLCP-yellow, LCD Trail trace: Monitor, setting Auxiliary output: Receive clock output, trigger output

• MU120015A ATM25M Unit

Bit rate	32.00 Mbps (25M)
Output signal	Connector: 8-pin modular jack, 100 Ω (RJ45) Clock: Internal (±10 ppm), external, receive Level: 2.7 to 3.4 Vp-p (1 symbol) Code: NRZI (4B/5B)
Input signal	Connector: 8-pin modular jack, 100 Ω (RJ45); Frequency: ±100 ppm; Level: 2.7 to 3.4 Vp-p (1 symbol); Code: NRZI (4B/5B)
Functions	Empty cell setting, coset on/off Error addition: Code, cell Alarm addition: LOS Error measurement: Code, HEC uncorrected cell, illegal cell Alarm measurement: LOS Sync event: Send, measure Auxiliary output: Receive clock output, trigger output

• MU120016A 6.3M Unit

Bit rate	6.312 Mbps (6.3M)
Output signal	Connector: BNC, 75 Ω Clock: Internal (±10 ppm), external, receive Level: 2 ±0.3 Vo-p Code: B8ZS
Input signal	Connector: BNC, 75 Ω Frequency: ±30 ppm Level: 2 ±0.3 Vo-p ∗Cable loss: 0 to 6 dB, Monitor: 20 dB attenuated level of above level can be applied. Code: B8ZS
Functions	Empty cell setting, cell scramble (de-scramble) on/off, coset on/off, HEC error correction on/off Error addition: Bit, CRC5, cell Alarm addition: LOS, AIS, RAI, LOF, LCD Error measurement: CRC5, HEC corrected cell, HEC uncorrected cell Alarm measurement: LOS, AIS, RAI, LOF, LCD Auxiliary output: Receive clock output, trigger output

• MU120017A 6.3/25M Unit

Bit rate	6.312 Mbps (6.3M), 32.00 Mbps (25M)
Output signal	Connector BNC: 75 Ω (6.3M); 8-pin modular jack, 100 Ω (RJ45, 25M) Clock: Internal (±10 ppm), external, receive Level: 2 ±0.3 Vo-p (6.3M), 2.7 to 3.4 Vp-p (25M, 1 symbol) Code 6.3M: B8ZS, 25M: NRZI (4B/5B)
Input signal	Connector BNC: 75 Ω (6.3M); 8-pin modular jack, 100 Ω (RJ45, 25M) Frequency range: ±30 ppm (6.3M), ±100 ppm (25M) Level: 2 ±0.3 Vo-p (6.3M), 2.7 to 3.4 Vp-p (25M, 1 symbol) ∗Cable loss: 0 to 6 dB (6.3M), Monitor: 20 dB attenuated level of above level can be applied (6.3M). Code 6.3M: B8ZS, 25M: NRZI (4B/5B)
Functions	Empty cell setting, cell scramble (de-scramble) on/off (6.3M only), coset on/off, HEC error correction on/off (6.3M only), sync event send (25M only) Error addition 6.3M: Bit, CRC5, cell 25M: Code, cell Alarm addition 6.3M: LOS, AIS, RAI, LOF, LCD 25M: LOS Error measurement 6.3M: CRC5, HEC corrected cell, HEC uncorrected cell 25M: Code, HEC uncorrected cell, illegal cell Alarm measurement 6.3M: LOS, AIS, RAI, LOF, LCD 25M: LOS Sync event (25M only): Send, measure Auxiliary output: Receive clock output, trigger output

• MU120020A QoS Unit

Foreground cells (test cells)	O.191, extended O.191, OAM test cell (PRBS 15), null, AAL1, AAL3/4, (For null, AAL1, AAL3/4, next pattern settable to payload. PRBS 9, PRBS 15, PRBS 15 (non-inverted), PRBS 23, time stamp, programmable)
Cell generation timing	CBR, burst, sawtooth waveform, CBR with CDV, VBR, Poisson distribution, manual, external edge, external level, detailed CBR, burst for UPC measurement, programmable
Background cell	CBR (10 types)
OAM cell	AIS, RDI, continuity check, loopback, programmable, forward monitoring, backward reporting, PM activation/deactivation, CC activation/deactivation
Capture	Capacity: 4095 cells Filter: All cells, specified cells, header +first byte of payload match/mismatch cells Trigger: Manual, OAM cell receive, cell error detect, cell loss detect, cell misinsertion detect, cell tagging, external input signal, etc. Display: Hexadecimal, ASCII, cell interval, translate
Single-channel	Error addition: Cell loss, cell error Error detection: Bit error, error cell, cell loss, cell misinsertion, non-conforming cell, etc. (measurement items differ according to test cell) Alarm detection: VP-AIS, VP-RDI, VP-LOC, VC-AIS, VC-RDI, VC-LOC Others: Bandwidth, total cells, cell delay measurement, 1 point CDV measurement, 2 point CDV measurement, cell interval measurement
1023 channel measurement (live monitor)	Detect and measure 1023 channels on line Measurement items: Total cell count, CLP = 0 cell count, CLP = 1 cell count, OAM cell count
Auxiliary input	Trigger input

• MU120021A Protocol Unit

Send/receive memory	8 MB (≥130,000 cells, send: 8 MB, receive: 8 MB, send + receive: 4 + 4 MB selectable)
Cell send	Transmit from memory according to time stamp. Able to transmit in every 1 cell. Able to edit AAL1, AAL3/4, AAL5 frame
Capture	Capacity: ≥130,000 cells (at 8 MB receive setting) Filter: All cells, all cells (excluding idle cells), up to 16 specified channels Trigger: Specified event, specified event occurrence times, sequential event (second event after first event) Event: Specified channel, SN abnormality, ST abnormality, CRC abnormality, specified pattern, external input signal, etc. Display: Cell, SAR, CPCS, time stamp
Single-channel measurement	AAL type automatic evaluation and measurement Error addition: Cell loss, cell error Measurement items: Cell count, CPCS-PDU count, assembled timer timeout PDU count, frame size error count, CPI error count, SN error count, ST error count, LI error count, about count, BE tag error count, BA size error count, AL error count, length error count, CRC error count, etc. (measurement items differ according to AAL type)
1023 channel measurement (live monitor)	Detect and measure 1023 channels on line. AAL type automatically detected and measured Measurement items: Cell count, CPCS count, etc. (measurement items differ according to AAL type)
External interface	Trigger input (capture event)

• MX122020A Protocol Decoding Software

Supported protocols	ATM (ITU-T I.361), OAM (ITU-T I.610), AAL5-CPCS (ITU-T I.363), SSCOP (ITU-T Q.2110), UNI 3.1/4.0 (ATM forum), LLC (RFC2225), SNAP (RFC2225), ATMARP/InATMARP (RFC2225), IP (RFC791), ICMP (RFC792), UDP (RFC768), TCP (RFC793)
Decoded file type	Data captured by MU120021A Protocol Unit and saved in binary format
Operating environment	MP1220B or a PC running with Windows 3.1/95/98

For product ordering information, see pages 4 – 10

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Mainframe	
MP1220B	ATM Quality Analyzer	
	Standard accessories	
	AC power cord:	1 pc
F0012	Fuse, 3.15 A:	2 pcs
W1304AE	MP1220B operation manual:	1 copy
W1305AE	MP1220B remote control operation manual:	1 copy
Z0339	Software recovery floppy disk*1:	1 pc
Z0340B	Protective cover (without keyboard):	1 pc
Z0343A	Input pen:	1 pc
Z0345A	Accessory bag:	1 pc
	Options	
MP1220B-01	RS-232C control	
MP1220B-02	GPIB control	
MP1220B-03	Ethernet control	
MU120001A-38	ST connector	
MU120001A-39	DIN connector	
MU120001A-40	SC connector	
MU120001A-43	HMS-10/A connector	
	Units	
MU120001A	STM-4/OC-12 Unit	
W1308AE	MU120001A operation manual	
W1314AE	MU120001A remote control operation manual	
MU120002A	STM-1/OC-3 Unit	
W1309AE	MU120002A operation manual	
W1315AE	MU120002A remote control operation manual	
MU120010A	T1/T3 Unit	
W1310AE	MU120010A operation manual	
W1316AE	MU120010A remote control operation manual	
MU120011A	E1/E3/E4 Unit	
W1311AE	MU120011A/120012A operation manual	
W1317AE	MU120011A/120012A remote control operation manual	
MU120012A	E1/E3 Unit	
W1311AE	MU120011A/120012A operation manual	
W1317AE	MU120011A/120012A remote control operation manual	

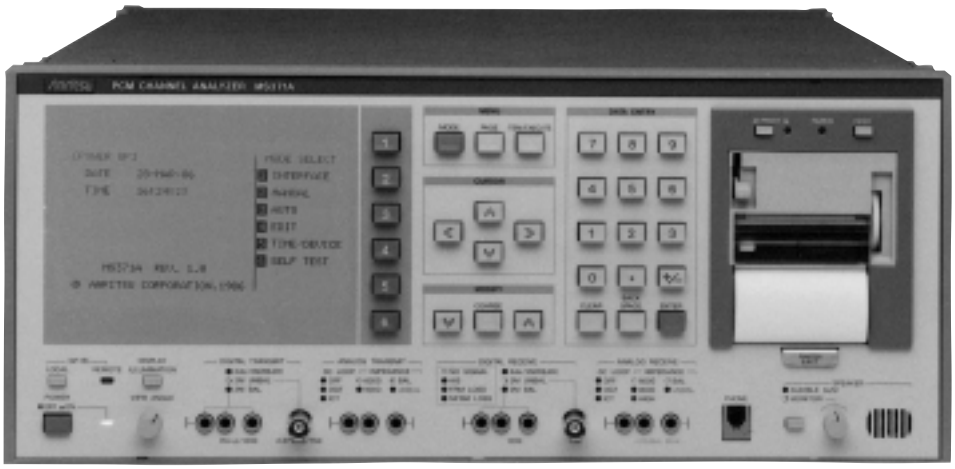
*1: Sold only to MP1220B users

Note: Please consult our sales department about adding the VBR functions to your MP1220B.
Windows is a registered trademark of Microsoft Corporation.

Model/Order No.	Name
MU120015A	ATM25M Unit
W1312AE	MU120015A/120016A/120017A operation manual
W1318AE	MU120015A/120016A/120017A remote control operation manual
MU120016A	6.3M Unit
W1312AE	MU120015A/120016A/120017A operation manual
W1318AE	MU120015A/120016A/120017A remote control operation manual
MU120017A	6.3/25M Unit
W1312AE	MU120015A/120016A/120017A operation manual
W1318AE	MU120015A/120016A/120017A remote control operation manual
MU120020A	QoS Unit
W1313AE	MU120020A operation manual
W1319AE	MU120020A remote control operation manual
MU120021A	Protocol Unit
W1371AE	MU120021A operation manual
W1372AE	MU120021A remote control operation manual
	Application software
MX122020A	Protocol Decoding Software
W1648AE	MX122020A operation manual
	Optional accessories
J0008	GPIB cable, 2 m
J0775D	Coaxial cord, 2 m (75 Ω)
J0776D	BNC cord, 2 m (twin shield)
J0635B	Optical fiber cord (FC/PC-FC/PC-2m-SM), 2 m
J0660B	Optical fiber cord (SC/PC-SC/PC-2m-SM), 2 m
J0796A	Replaceable optical connector (ST)
J0796B	Replaceable optical connector (DIN)
J0796C	Replaceable optical connector (SC)
J0796D	Replaceable optical connector (HMS-10/A)
J0796E	Replaceable optical connector (FC)
J0844A	ISO 10173 cable (T1), 2 m
J0838A	UTP category 3 cable (25M), 2 m
Z0319A	PS/2 mouse
Z0340A	Protective cover (with keyboard)
Z0340B	Protective cover (without keyboard)
B0414A	Hard case
B0163	Soft case

PCM CHANNEL ANALYZER
MS371A/A1

For Simultaneous Measurement of 30 Channels with MS120A



CE (MS371A1) GPIB

The MS371A/A1 is an overall measuring instrument with many measuring functions for digital primary hierarchy transmission. It can be used to measure (1) voice encode/decode performance characteristics, (2) frame alignment/alarm test, (3) bit, code, and frame errors, (4) timing jitter, and (5) signalling, etc.
The primary hierarchy (PCM) digital transmission system has been commonly used as the foundation for ISDNs. Therefore, there are many existing equipment and transmission channels to be maintained. The necessary measurements are diverse and much time and labor is needed to evaluate them when commissioning and maintaining transmission circuits and equipment. The increasing number of PCM systems has made improved measurement evaluation efficiency a necessity.
The Anritsu MS371A/A1 has most of the functions required to measure PCM systems. It is an all-purpose measuring instrument designed to improve measurement efficiency. Measurements of PCM voice encode/decode performance require much time and labor. The MS371A/A1 stores the measurement sequence and parameters in its internal memory and makes automatic measurements to markedly improve efficiency. It has a GPIB control function, which with the MS120A Channel Selector permits measurement of 30 channels in one sequence. It also compares the measured results to a reference value, judges them, and displays GOOD or NO GOOD automatically. The measured results can then be printed out on the built-in printer. Another special feature is that the report of the measured results can also be printed out an external printer.
In conventional measuring systems, the results are edited by a personal computer or some other external device. However, the MS371A/A1 performs this function internally and prints out to the external printer. This unique function can instantaneously prepare test performance sheets during installation and report the results of periodic maintenance without the need for manual or computer evaluation.

Features

- **Automatic measurement of A-A, A-D, D-A and D-D (A: analog, D: digital)**

This analyzer automatically measures most of the items stipulated in ITU-T Rec. G.712/713/714. The test sequence and parameters are stored internally, and new test sequences or parameters can be entered by the operator. Also, measurement can be done manually or via GPIB.

- **Frame alignment/alarm test**

Frame alignment and alarm tests stipulated in ITU-T Rec. G.704/O.162 can be made.

- **Error measurement**

Error rate, error count, error second, and % error-free second can be measured by detecting the bit, frame, and code errors.

- **Timing jitter measurement**

Jitter modulation is available. Also jitter amplitude and jitter immunity can be measured.

- **Signalling measurement**

Manipulation/monitoring of the signalling bit and E&M signalling distortion can be measured.

- **GPIB controller**

A GPIB controller function has been incorporated. One to thirty channels can be tested automatically and continuously through the channel selector.

- **Built-in printer**

Results are printed out by the built-in printer. In automatic measurement, all results can be printed out or the printout can be limited to results failing the evaluation.

- **External printer**

Results from channels 1 to 30 can be edited according to measuring item and printed out. A report, such as a test performance sheet, can be prepared immediately after the completion of measurements.

For product ordering information, see pages 4 – 10

Functions

• Automatic measurement mode

In the automatic measuring mode, voice encode and decode performance characteristics can be measured. Encode and decode performance characteristics in the voice frequency are recommended in ITU-T Rec. G712/713/714/792 Q.507. Many items are required for voice frequency evaluation, and many points must be measured for each item.

In attenuation/frequency distortion, some compensation of the measurement value is required for each measurement frequency because of the absolute level difference caused in the reference frequency. Manual correction requires much time and effort to obtain the correct result.

The MS371A/A1 stores the reference frequency, the level difference in the frequency, the subsequent frequency for measurement, and the procedure for compensation operations at each frequency. As a result, the corrected result is reached automatically. Then the measured result is compared to a reference value in the memory to evaluate whether or not it passes or fails; evaluation is automatic.

If it fails, the item, condition, and results can be printed out (fail-only printout or complete printout of results can be selected). In automatic measurement, the MS371A/A1 can measure the 15 items shows in the table below, including attenuation/frequency distortion. The measurement table summary indicates whether items can be measured or not by comparing the measurement configuration with measurement items. Functions that cannot be executed cannot be measured in principle.

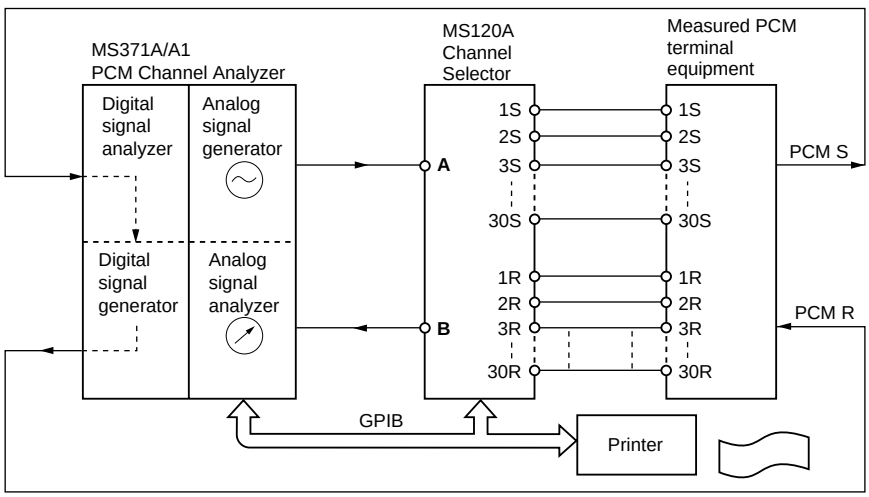
Summary of automatic measurement

Measurement item	Measurement configuration				
	A-A	A-D	D-A	D-D	A-D/D-A*2
Level setting	√	√	√	√	√
Attenuation frequency distortion	√	√	√	√	√
Variation of gain with input level (tone)	√	√	√	√	√
Variation of gain with input level (noise)	√	√	√	√	√
Total distortion including quantizing distortion (tone)	√	√	√	√	√
Total distortion including quantizing distortion (noise)	√	√	√	√	√
Idle channel noise	√	√	√	√	√
Far-end crosstalk		√*1	√*1		√*1
Near-end crosstalk	√*1			√	
Go-to-return crosstalk	√			√	
Return loss	√*1	√*1	√*1		√*1
Spurious out-of-band signal	√		√		√
Discrimination against out-of-band input signal	√	√			√
Longitudinal balance	√	√	√		√
E&M signalling distortion	√	√	√	√	√

∗1: Only when used with channel selector
∗2: Measures D/A immediately after measuring A/D

As an application example, the measurement of PCM terminal voice encode and decode performance characteristics is shown below. This measuring method is used when installing PCM terminal equipment. Measurement items shown in the table of measurement summary are executed in the measuring sequence programmed into the MS371A/A1. (The operator can set individual items to be executed or omitted.) After measurement in channel 1, the MS371A/A1 controls the MS120A Channel Selector via the GPIB, connects the measuring terminal of the MS371A/A1 to channel 2 of the PCM terminal equipment, and remeasures.

Measurement of one system portion of the terminal equipment is finished from channel 1 to 30 automatically in the same way. Upon completion of measurement, the measured results of channel 1 to 30 are edited according to each measurement item and output to the external printer. As mentioned above, voice channel measurement is fully automated, with no chance for miss operation.



The MS371A/A1 controls the MS120A Channel Selector via GPIB. Port A scans from 1R to 30R and port B scans from 1S to 30S. This permits automatic testing of 30 PCM channels (1 system).

Four-wire VF interface PCM terminal equipment automatic testing

• Manual measurement mode

Table 1 summarizes the manual measurements. Manual measurements can be classified broadly as follows: voice channel, word test, alarm simulation, error measurement, signalling measurement, jitter measurement, and order wire.

Voice channel measurement

Manual measurement is used when varying the parameters more finely than in automatic measurement or when no measurement can be made in automatic measuring sequences, as in end-to-end measurement. Manual measurement is also suited to observing changes in results over time.

Word test

Voice channel, frame, non-frame, and multiframe words can be manipulated or monitored. Thus, spare bits included in the multiframe and non-frame can be functionally tested and defined and by the circuit user. The drop insert function of the voice channel can also be tested.

Alarm simulation

Frame, multiframe, or signal loss pseudo-errors can be inserted into the signal by the MS371A/A1 to test the alarm response of the equipment.

Error measurement

Per-channel (64 kbit/s) bit errors can be measured. Bit, line code, and frame word errors at 2 Mbit/s can also be measured. The error rate, error second, and % error-free second of these errors can then be automatically calculated.

Jitter measurement

In the digital signal generator, jitter can be generated at 2 Mbit/s interface and the digital signal analyzer can measure the jitter in a received signal. Combined use of jitter generation and error measuring functions enables measurement of jitter immunity.

Order wire

The front panel of the MS371A/A1 has a phone jack. Connection of a handset permits use of the circuit to be measured as an order wire.

Table 1 Manual measurement summary

Measurement item		Measurement configuration			
		A-A	A-D	D-A	D-D
Level measurement	Tone (FLM)	√	√	√	√
	Tone (SLM)	√	√	√	√
	Noise	√	√	√	√
Gain measurement	Tone (FLM)	√	√	√	√
	Tone (SLM)	√	√	√	√
	Digital mW (FLM)			√	√
	Digital mW (SLM)			√	√
	Noise	√	√	√	√
Total distortion including quantizing distortion	Tone	√	√	√	√
	Noise	√	√	√	√
Idle channel noise		√	√	√	√
Return loss		√			
Spurious out-of-band signal		√		√	
Coder offset	Tone		√		√
	Noise		√		√
Peak code detection	Tone		√		√
	Noise		√		√
Longitudinal balance		√	√	√	
Word test	Voice channel				√
	Frame				√*1
	Non frame				√*1
	Multiframe				√*2
Alarm simulation	AIS				√*1
	Signal loss				√*1
	Frame error				√*1
	Multiframe error				√*1
	Remote end frame error				√*1
	Remote end multiframe alarm				√*2
Error measurement	Error rate				√
	Number of errors				√
	Error seconds				√
	% error free seconds				√
Signalling measurement	E&M signalling distortion	√	√*3	√*4	√*2
	Bit test				√*2
Jitter measurement	Jitter immunity				√*5
	Jitter				√*6
Order-wire circuit		√	√	√	√

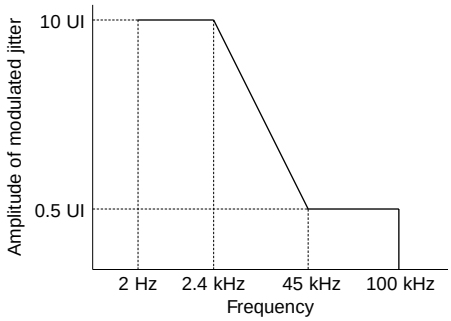
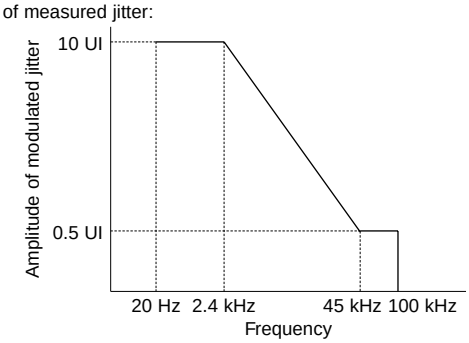
∗1: When both digital interfaces of the transmitter/receiver are 2 M balanced or unbalanced
∗2: When both digital interfaces of the transmitter/receiver are 2 M balanced or unbalanced 30 channels, CAS
∗3: When the digital interfaces of the receiver is 2 M balanced or unbalanced 30 channels, CAS
∗4: When the digital interfaces of the transmitter is 2 M balanced or unbalanced 30 channels, CAS
∗5: When the digital interface of the transmitter is 2 M balanced or unbalanced
∗6: When the digital interface of the receiver is 2 M balanced or unbalanced

For product ordering information, see pages 4 –10

Specifications

Analog signal generator	Sine wave signal output	Frequency range: 200 Hz to 10 kHz Frequency resolution: 10 Hz Frequency accuracy: ±0.1% ±0.1 Hz Spurious including harmonics: >70 dB down (400 to 3500 Hz, +5 dBm), >60 dB down (200 to 400 Hz, +5 dBm), >50 dB down (3500 to 10000 Hz, +5 dBm) Level range: –80 to 13.1 dBm Level resolution: 0.1 dB
	Noise signal output Conforms to ITU-T Rec. O.131	Spectral span: 3.9 Hz Bandwidth: 200 Hz (350 to 550 Hz) Repetition rate: 256 ms Level range: –85 to 0 dBm Level resolution: 0.1 dB
	Output interface	Connector: 3-pole CF Impedance: 600, 900 Ω balanced Relative level: –20 to 10 dBr, 0.1 dB steps Max. DC isolation: ±60 V DC loop: ICT, OGT selectable Current direction: Normal, reverse selectable (ICT only)
Activating signal generator		Spectral span: 7.81 Hz Bandwidth: 200 Hz Output level: –55 dB0 nominal Output interface: Same as analog signal generator
Analog receiver	Filters	In-band pre-filter: 200 to 6000 Hz Out-of-band pre-filter: 4.2 to 72 kHz Psophometric filter: Conforms to ITU-T Rec. O.41 3 kHz flat filter: 300 to 3400 Hz Band pass filters: 200, 300, 420, 500, 600, 820, 1020, 2400 2800, 3000, 3400, 3600 Hz selectable Notch filters: 820, 1020 Hz selectable Filter for S/N meter: Conforms to ITU-T Rec. O.131
	Input interface	Connector: 3-pole CF Impedance: 600, 900 Ω, high (> 20 kΩ), balanced, unbalanced selectable Relative level: –20 to +10 dBr, 0.1 dB steps Max, DC isolation: ±60 V DC loop: ICT, OGT selectable Current direction: Normal, reverse, selectable (ICT only)
Digital signal generator	Sine wave signal output	Frequency range: 200 to 3990 Hz Frequency resolution: 10 Hz Frequency accuracy: ±0.1%, ±0.1 Hz Level range: –60 to 3.1 dBm0 Level resolution: 0.1 dB
	Noise signal output Conform to ITU-T Rec. O.131	Spectral span: 3.9 Hz Bandwidth: 200 Hz (350 to 550 Hz) Repetition rate: 256 ms Level range: –65 to 0 dBm0 Level resolution: 0.1 dB
	Digital mW signal	Conforms to ITU-T Rec. G.711
	Alarm simulation signal	PCM alarm signals: AIS, signal loss selectable Frame error signals: 1 in 2, 2 in 4, 3 in 4, 1.5 x 10^{-3}, 1.5 x 10^{-4}, 1.5 x 10^{-5}, 1.5 x 10^{-6} selectable Multiframe error signal: 1 in 2, 2 in 2 Remote end frame alarm: Alarm bit “0” or “1” settable Remote end multiframe alarm: Alarm bit “0” or “1” settable
	Word pattern manipulation	Telephone channel time slot: 00000000 to 11111111 settable Frame word: 00000000 to 11111111 settable Non-frame word: 00000000 to 11111111 settable Multiframe word: 00000000 to 11111111 settable
	Error measurement signal	Pseudo-random binary sequence for 64 kbit/s: 2^{11}–1 (ITU-T Rec. O.152) Pseudo-random binary sequence for 2.048 Mbit/s: 2^{15}–1 (ITU-T Rec. O.151)
	Signalling bit test signal	Possible to set logic “0” or “1” to selected signalling channel in any bit: a, b, c
	Signalling distortion measurement signal (possible to inject measurement signal to selected signalling channel in any bit: a, b, c, d)	Pulse speed: 10, 20 pps selectable Marker ratio: 10 to 90%, 1 % steps
	PCM output interface Conforms to ITU-T Rec. G.703, G.704 (2.048 MHz, however, CRC code is not inserted)	Output impedance: 120 Ω balanced, 75 Ω unbalanced selectable Telephone channel number: 30, 31 channels selectable Signalling: Channel associated signalling, common channel signalling selectable Coding: HDB3, AMI selectable Synchronization: Internal, external 8 kHz frame signal (TTL), external 2.048 MHz clock signal (TTL) or from digital signal receiver selectable Connector: 3-pole CF (120 Ω bal.), BNC (75 Ω unbal.)
	TTL output interface	Telephone channel number: 32 channels at 2.038 Mbit/s, signal channel at 64 kHz Synchronization: Internal, external 8 kHz frame signal (TTL), external 64 kHz (64 kbit/s interface), external 2.048 MHz (2.048 Mbit/s interface) or frame signal from digital signal receiver Connector: D-sub 25 pole (rear panel)

Continued on next page

Digital receiver	Filters	Psophometric filter: Conforms to ITU-T Rec. O.41 3 kHz flat filter: 300 Hz to 3.4 kHz Band pass filter: 200, 300, 420, 500, 600, 820, 1020, 2400, 2800, 3000, 3400, 3600 Hz selectable Notch filter: 820, 1020 Hz selectable Filter for S/N meter: Conforms to ITU-T Rec. O.131
	Alarm display	Signal loss, AIS, frame loss, multiframe loss is indicated with the red LED display.
	Coder offset detection	Measurement range: –128 to +128
	Peak code detection	Measurement range: –128 to +128
	Remote end alarm detection	Remote end frame alarm, remote end multiframe alarm
	World pattern monitor	Telephone channel, frame word, non-frame word, multiframe word
	Error detection	Detectable error: Code, frame, word, bit Measurement item: Error ratio, errored second, % error-free second, error count Acceptable bit error measurement pattern (64 kbit/s): 2^{11}–1 (ITU-T Rec. O.152) Acceptable bit error measurement pattern (2.048 Mbit/s): 2^{15}–1 (ITU-T Rec. O.151) Time base: 1 to 9999 s
	Signalling bit monitor	Possible to display on selected signalling channel in a, b, c, d bit
	Signalling distortion meter (possible to measure selected signalling channel in any bit: a, b, c, d)	Acceptable pulse speed: 10, 20 pps Mark ratio range: 0 to 100%
	PCN input interface Conforms to ITU-T Rec. G.703, G.704 (2.048 MHz)	Input impedance: 120 Ω balanced, 75 Ω unbalanced selectable Number of telephone channels: 30, 31 channels selectable Signalling: Channel associated signalling, common channel signalling selectable Coding: HDB3, AMI selectable Synchronization: Regenerated frame and multiframe from incoming PCM signals Connector: 3-pole CF (120 Ω bal.), BNC (75 Ω, unbal.)
	TTL input interface	Number of telephone channels: 32 channels at 2.048 Mbit/s, single channel at 64 bit/s Synchronization: External 8 kHz frame signal Connector: D-sub 25-pole (rear panel)
Jitter detection (PCM interface only)		Frequency mode: Conforms to ITU-T Rec. O.171 Amplitude of modulated jitter:  Range: 1 UI, 10 UI selectable Amplitude and frequencies: Conforms to ITU-T Rec. O.171 Amplitude of measured jitter: 
E&M test signal generator	Measurement parameters	Pulse speed: 10, 20 pps selectable Mark ratio: 10 to 90%, 1% steps
	Interface	DC sink current: 100 mA maximum (make) Output impedance: >22 kΩ (brake) Switch voltage: 53 V maximum Connector: 3-pole CF (rear panel)
E&M signalling receiver	Measuring range	Pulse speed: 10 to 20 pps Mark ratio: 0 to 100%
	Interface	Input impedance: 3.3 kΩ internally pulldown to –48 V Connector: 3-pole CF (rear panel)

Continued on next page

For product ordering information, see pages 4 – 10

Others	Order wire	Voice signal output: Analog signal generator or selected digital signal generator output port Voice signal input: Analog signal receiver or selected digital signal receiver input port Headset connector: 4-pole modular telephone jack
	Loudspeaker (for audible alarm and received voice monitor)	Monitor: Selected telephone channel in digital signal or analog input signal Monitor level: Adjustable with knob on front panel
	Display	128 x 256 dots LCD with back light
	Built-in printer	Printing method: Thermal Printing letter: 20 characters/line
	Real time clock	YY, MM, HH, mm, ss (Y: year, M: month, D: date, H: hour, m: minute, s: second)
	GPIB (conforms to IEEE Std. 488-1978)	Implementation: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C1, C2, C3, C27
General	Power	AC: 100 V $^{+10}_{-15}$%, 50/60 Hz, approx. 130 VA
	Dimensions and mass	425 (W) x 177 (H) x 451 (D) mm, ≤25 kg
	EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
	LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)

The MS371A1 is the same as the MS371A but also has 64 kb/s co-contradirectional interface.

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MS371A	PCM Channel Analyzer	
MS371A1	PCM Channel Analyzer	
	Standard accessories	
J0162B	Balanced cable (both ends with Siemens 3P-type plug):	4 pcs
J0081	BNC cable (both ends with BNC-type plug):	2 pcs
J0586	TTL interface connector:	1 pc
	AC power cord, 2.5 m:	1 pc
J0443	DC power plug:	1 pc
F0011	Fuse, 2 A:	1 pc
F0012	Fuse, 3.15 A:	2 pcs
F0040	Fuse, 0.315 A:	1 pc
F0043	Fuse, 1 A:	3 pcs
F0044	Fuse, 1.6 A:	1 pc
F0046	Fuse, 3.15 A:	2 pcs
Z0031A	Thermal paper for printer:	2 rolls/set
W0161AE	MS371A/A1 operation manual:	1 copy
	Optional accessories	
MS120A*1	Channel Selector	
J0162A	Balanced cable, 1 m	
J0081	BNC cable (both ends with BNC-type plug, 3C-2V), 2 m	
A0006	Headset	
MB23A	Portable Test Rack	
MB24A	Portable Test Rack	
J0007	GPIB cable, 1 m	
J0008	GPIB cable, 2 m	
B0169A	Transport quilting	
B0239A	Protective carrying case (for MS371A)	
B0239B	Protective carrying case (for MS371A1)	
B0043	Rack mount kit 4U (2 pcs/set)	
B0020	Protective cover (2 pcs are needed.)	

*1: Do not meet the EMC and low voltage directives of European Union.

DIGITAL TRANSMISSION ANALYZER
ME3401A

For Measuring Error of DS-3, DS-2, DS-1C and DS-1 Systems

GPIB
OPTION

The ME3401A offers portability and easy operation and is ideal for testing, evaluating, and monitoring DS-2, DS-1C, and DS-1 system as well as the DS-3 system. This multifunctional instrument has five error detection functions (bit, parity, frame, bipolar violation, and CRC-6), seven measurement functions (error rate, error count, error seconds, % error free seconds, threshold error seconds, error performance data, and alarm seconds), jitter modulation and measurement functions, and multiplexer test functions. These functions make the ME3401A a powerful tool for commissioning, and production tests, as well as for maintaining, and troubleshooting digital radios, fiber optic systems, and digital multiplexers. In addition, live traffic performance can be measured by using a wide input range, the frame error detection function, the demultiplex function, and the built-in printer. The printer outputs the measurement results and automatically records the time, and contents when an error or alarm occurs. The receiver makes it easy to measure the error rate or error count distribution and error performance*. *: ITU-T G.821

Features
- Suitable for all systems: DS-3, DS-2, DS-1C, and DS-1
- Jitter modulation and measurement (option)
- Demultiplex function
- Various error detection and measurement functions
- Through data function

STM/SONET ANALYZER
MP1560A

Supports Japanese, ITU-T and SONET Specifications

Custom-made product

GPIB

The MP1560A STM/SONET Analyzer is an error analyzer for the Network Node Interface (NNI) of the Synchronous Digital Hierarchy (SDH). The MP1560A provides many useful functions for evaluating equipment during design, manufacturing, and development and is especially suited for evaluating the transmission characteristics of the 52, 100, and 156 Mb/s interfaces used in SDH equipment.
The transmitter and receiver are housed in one frame and optical interfaces (plug-in unit) are provided. In addition to functions for setting and storing 64 frames of data in memory (option 01), a PTA controller function (option 03/04) and 28-channel (maximum) simultaneous measurement function (option 02) can be built-in.

Features
- Meets mappings for ITU-T (Europe), SONET (North America), and Japan
- Can be used to analyze a variety of signal sources: optical (1.31/1.55 µm), unipolar, CMI, B3ZS (52 Mb/s), AMI (100 Mb/s)
- Many measurement items and functions for inserting alarms and errors
- OH byte can be set and monitored
- ADD and DROP for 1.5 Mb/s, 2 Mb/s, 64 kb/s, 192 kb/s, 576 kb/s
- Built-in floppy disk drive

PCM CODEC ANALYZER
MS369B

For Measuring CODECs

GPIB

The MS369B uses new technology to measure the characteristics of PCM CODECs (Coder, Decoder). Single-channel CODECs (SCC) are already being produced by many semiconductor makers for PCM terminal equipment, digital exchanges, PBX, digital telephones, and so on. The number of SCCs in use is increasing gradually. In addition, former common-channel CODECs used time sharing among a number of channels. Measuring the characteristics of one single channel make it possible to dispense with measurement of the other common channels. For equipment using SCCs, however, the encoding and decoding characteristics for each channel must be measured. As a result, more channels must be measured which will lead to demands for improved measuring performance.
The MS369B uses DSP (Digital Signal Processing) technology to reduce measuring time and to improve measuring accuracy. It also incorporates a high-performance, special-purpose LSI developed by Anritsu. The MS369B reduces measuring time and automates measurement using GPIB, and increases production and maintenance efficiency.

Features
- Both A-law and µ-law measurement
- A-A, D-A, A-D, and D-D measurement

For product ordering information, see pages 4 – 10